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ABSTRACTS

of recent published material on Soil and Water Conservation

Number 39

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ARS 41-75-15 Issued July 1966

The "ABSTRACTS of recent published material on Soil and Water Conservation" are issued at irregular intervals. Their purpose is to bring together a summary of current published information about soil and water conservation work. Reprints of abstracted articles are generally not available in the Soil and Water Conservation Research Division. Request for reprints should be sent to the authors or institutions; addresses are appended.

The classification of articles follows the table of contents used for the "Soil and Water Conservation Research Needs" of the Soil Conservation Service. Abstracted articles are not editorialized and the language of the author is used wherever possible. In foreign articles, the units of measure are converted to usual American units. Tables are included where they help to present the information. When the entire number of a publication is devoted to reviewing one subject then the entire publication is abstracted as one article giving title and authors of each paper included in the publication. Abbreviations of journals and addresses follow U.S.D.A. Misc. Pub. 765, July 1958.

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Charles B. Crook, Soil and Water Conservation Research Division
Agricultural Research Service, U.S. Department of Agriculture,
Plant Industry Station, Beltsville, Maryland, 20705.

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WATERSHED ENGINEERING

Watershed Development

See Also 31, 156, 160, 259, 274, 324.

1. Steele, H. A., and Green, W. A. MANAGEMENT OF WATER RESOURCES FOR REGIONAL DEVELOPMENT. Conf. Res. Strategy Reg. Develop., Ames, Iowa, Oct. 13-14, 1964.

The relation of water resources to economic activity was explored by using the findings of the Senate Select Committee studies on water supply and demand. Comprehensive river-basin planning was described, and an approach was outlined to the formulation of framework plans for river basins. Also, problems and issues for research and public decision were outlined.

RDED, ERS, USDA, Washington, D.C., 20250

2. Martinelli, M., Jr. WATERSHED MANAGEMENT IN THE ROCKY MOUNTAIN ALPINE AND SUB-ALPINE ZONES. U.S. Forest Serv. Res. Note RM-36. 6 pp. 1964.

A report was given on the various types of research being carried out in that area on watershed management.

Rocky Mountain Forest and Range Expt. Sta., FS, USDA, Ft. Collins, Colo., 80521

3. King, B. TERRAPIN CREEK WATERSHED. Land & Water Contract. 6(9): 11, 14-15. Sept. 1964.

An illustrated report was given on the work progress in the Terrapin Creek Watershed by the Terrapin Creek Conservancy District in northeast Alabama.

The watershed contains approximately 1,150 farms, ranging in size from 20 acres to 1,200 acres. Land treatment measures for watershed protection will be provided by farmers in cooperation with their local soil and water conservation districts.

The watershed work plan provides for construction of 10 floodwater retarding dams, involving 817,424 cubic yards of fill. The 17.5 miles of channel improvement involved 578,138 yards of excavation.

The total project installation cost was estimated at $2,263,029, of which the P.L. 566 share was $1,316,154.

Land and Water Contract., P.O. Box 481, Barrington, Ill., 60010

4. Christiansen, R. A., and Staniforth, S. D. ECONOMIC EVALUATION OF CHANGES IN THE USE OF FLOOD PLAIN LANDS (BASED ON A STUDY OF WISCONSIN MILL CREEK WATERSHED). Wis. Agr. Expt. Sta. B. Ag. Ec. 41, 30 pp. 1964.

The Wisconsin Mill Creek Watershed Work Plan, developed and approved in 1956, anticipated that 449 acres would be converted from pasture to cropland on the flood plain as a direct result of the flood control program. It was estimated that for each acre converted, annual net farm income would be enhanced by $22. This provided a total annual benefit of $9,878, a substantial contribution to a favorable benefit-cost ratio upon which the approval of the watershed project depended.

By the end of the 1961 crop year, farmers interviewed in the watershed had converted from pasture to cropland a total of 249 acres, or an average per farm of 5.1 acres of flood plain land. However, due to easement problems and other land acquisition difficulties, the project was not completed in 1961, and 18 out of the 49 farmers interviewed were still not receiving flood protection.

Although 249 acres of new cropland were available by 1961, this did not result in a new gain in cropland. In 1957, the 49 farmers with land on the flood plain averaged 66.5 acres of cropland; by 1961 the average was 65.6 acres. Although the majority of the farms need more cropland, the farmers tended to farm less land on the steeper slopes as more cropland became available on the flood plain. Significantly, such soil-depleting crops as corn and tobacco were shifted from the steeper, eroded slopes to the more protected lands on the flood plain.

Net cash income per acre of cropland had increased only from $39 to $41 by the end of the 1961 crop year or "after" partial flood control.

The greatest restraint to farm income improvement in the watershed was the lack of adequate cropland. Farms averaged 187 acres per farm with only 66 acres in cropland.

U. Wis., Col. Agr., Madison, Wis., 53706

5. Christiansen, R. A., and Staniforth, S. D. THE ECONOMIC IMPLICATIONS ASSOCIATED WITH PROPOSED LAND USE CHANGES IN THE WISCONSIN "TWIN PARKS" WATERSHED. Wis. Agr. Expt. Sta. B. Ag. Ec. 39, 22 pp. 1964.

Agricultural economic information and data based on findings in the Wisconsin Twin Parks Watershed were provided. The data were obtained before flood control, with the objective of providing a "benchmark" for a more comprehensive future research investigation. The future study has the following objectives: (1) To determine the effect of the flood control program on conversion from pasture to cropland in the flood plain; (2) to evaluate the economic significance of such land use changes upon farmers' cropping and livestock programs; (3) to compare results (after flood control) with the projected or estimated changes included in the Twin Parks Watershed work plan; and (4) if necessary, to suggest changes in procedure for estimating flood plain benefits.

A total of 340 farm familes used land in the watershed for agricultural purposes. Their farms averaged 207 acres, with 82 acres of cropland.

Fifty-four out of the 340 farmers have land in the flood plain which would be affected by the proposed flood control program. According to the Twin Parks Watershed work plan, 437 acres of pasture (slightly over 8 acres per farm) are to be converted to cropland. The annual enhancement value of each acre so converted was estimated at $24.81, for a total of $10,842. This amount is about one-fourth of the total benefits included in the project's favorable benefit-cost ratio.

The authors concluded that the watershed project can make a substantial economic contribution to all farmers in the watershed, particularly the 54 with flood plain land. However, this contribution can come about only under a watershed program which supports effective conservation and the efficient use of all agricultural resources.

U. Wis., Col. Agr., Madison, Wis., 53706

Hydrology

See Also 13, 14, 52, 65, 66, 67, 147, 168, 219.

6. Hale, D. D., and Beasley, R. P. HYDROLOGIC INVESTIGATIONS OF THE BURGE BRANCH WATERSHED. Mo. Agr. Expt. Sta. Res. B. 863, 44 pp. 1964.

Cooperative studies are now being made on the 216-acre Burge Branch Watershed located near Arrow Rock, Mo., to determine the relationships of rainfall to runoff.

The watershed is composed of rolling upland with slopes ranging from 3 to 7 percent. The drainage channels of the watershed are well defined. Soils on the watershed are Sharpsburg and Grundy. Instrumentation for this watershed consists of a weir, a water-level recorder, and two recording rain gages.

The records collected between October 8, 1959, and October 1, 1962 were reported. The records were divided into water years, each beginning October 1 and ending on September 30.

The three highest peak rates and volumes of runoff obtained during the 3 water years were presented. Both the highest peak rate and volumes of runoff obtained during the 3 water years were presented. Both the highest peak rate and volume of runoff occurred during one storm. During this storm (September 13, 1961), 6.1 inches of rain fell within 12 hours, producing a peak flow of 134 c.f.s. and a volume of 1.34 inches of runoff. This storm had a frequency of occurrence of 75 years for a 12-hour duration, but less than a 2-year frequency of occurrence for a 40-minute duration. The second highest peak rate of runoff (March 7, 1961) amounted to 112 c.f.s., and resulted from a 1.33-inch rain over a 1-hour period. The third highest peak rate of runoff (November 15, 1960) amounted to 66.8 c.f.s., and resulted from a rain of about 1.2 inches over a 1-hour period. The second highest volume of runoff (March 20, 1962) amounted to 1.25 inches from a 2.2-inch rain over a 16-hour period. The third highest volume of runoff (May 5, 1960) amounted to 0.80 inch of runoff, and resulted from a rain of 2.71 inches over a 6-hour and 45-minute period.

The mass rainfall and runoff curves for 2 water years were presented. Total rainfall for the 1960 water year was 25.6 inches; for the 1961 water year, 50.4 inches. Total runoff for the 1960 water year was 3.18 inches; for the 1961 water year, 8.40 inches.

Data obtained during an additional group of storms were presented to indicate the types of hydrographs collected from the Burge Branch Watershed. The storms were grouped by rainfall intensities, and included only intense, abrupt rains that fell evenly over the watershed and had a duration of less than the 50-minute lag time for the watershed.

Several of the collected hydrographs contained double peaks. All of the hydrographs from storms prior to May 25, 1960—when most of the terraces were built on the upper part of the watershed—had only one peak. Hydrographs of short intense storms after this date had two peaks. The longer storms after May 25, 1960, continued to produce hydrographs with one peak.

The terraces built at the upper end of the watershed in 1960 caused a change in the lag time for the watershed. The average lag time for eight storms occurring prior to May 25, 1960, was 32 minutes; for seven storms occurring between May 25 and December 31, 1960, it was 42 minutes; and for seven storms occurring after December 31, 1960, 50 minutes.

Tables, maps, and graphs.

U. Mo., Col. Agr., Agr. Expt. Sta., Columbia, Mo., 65202

7. Berndt, H. W. INDUCING SNOW ACCUMULATION ON MOUNTAIN GRASSLAND WATERSHEDS. J. Soil and Water Conserv. 19(5): 196-198. 1964.

The results of a snow-fence spacing study showed that on upland flat areas in southeastern Wyoming during winters with average snowfall, 325 feet was the most effective tested spacing for 4-foot snow fence erected to limit snow movement by wind. At this interval, fence with 40-50 percent density and placed 0.5 feet above the ground accumulated drifts that had a maximum height of 4.5 feet, extended an average of 106 feet downwind from the fence, and contained about 110 cubic feet of water per lineal foot of fence.

Experimental watersheds of 85 to 145 acres in the Pole Mountain area have been equipped with stream-gaging stations, and streamflows are being calibrated. After stream calibration has been achieved, snow fences will be constructed on an entire drainage, to determine their influence on volume and timing of water yields.

Rocky Mountain Forest and Range Expt. Sta., FS, USDA, Fort Collins, Colo., 80521

8. Burt, O. R. THE ECONOMICS OF CONJUNCTIVE USE OF GROUND AND SURFACE WATER. Hilgardia 36(2): 31-111. 1964.

Water storage control under conditions of conjunctive use and the role of storage control in guiding investment decisions in water resource development were reported. Modern sequential decision theory was applied to water storage control to provide a theoretical framework for economic analysis. The theoretical model was utilized in an empirical investigation concerned with marginal value of imported water. The region chosen for study is serviced by Pine Flat Reservoir on the Kings River in the San Joaquin Valley of California.

Agr. Pub., University Hall, U. Calif., Berkeley, Calif., 94720

9. Renard, K. G., Keppel, R. V., Hickey, J. J., and Wallace, D. E. PERFORMANCE OF LOCAL AQUIFERS AS INFLUENCED BY STREAM TRANSMISSION LOSSES AND RIPARIAN VEGETATION. Trans. ASAE 7(4): 471-474, 477. 1964.

Local aquifers are important sources of water in the semiarid rangeland areas of the Southwest. Recharge of these aquifers results mainly from stream transmission losses as reflected by the ground water contours prior to and following a runoff event. Although recharge from direct precipitation has been experienced in the aquifer, the small increases in the water-surface elevation were insignificant when compared to those resulting from surface flow events.

Reduction of the riparian vegetation (predominantly mesquite) should substantially increase the amount of water available for beneficial uses. The ratio of the decline in water surface during the growing season when compared to the dormant season was 5:1.

When impervious material underlies the channel alluvium, lateral subsurface movement of water down the channel axis contributes to the storage in these aquifers.

Southwest Rangeland Hydrology Res. Watershed, SWCRD, ARS, USDA, Tucson, Ariz., 85717

Geology

See Also 8, 15, 40, 45, 48, 58, 148.

10. Swenson, H. A. SEDIMENT IN STREAMS. J. Soil and Water Conserv. 19(6): 223-226. 1964.

Whether stream sedimentation is solely a function of the action of natural forces or the result of man's inept use of the land, the economic and engineering implications of it are of great consequence. Extensive investigations have been conducted to gain a better understanding of the complex mode of occurrence and significance of sediment in streams. Aspects of such studies considered were: (1) The discharge of suspended sediment as a time-dependent function, with particular reference to sediment flows of small, headwater streams; (2) effects of urban development on stream sedimentation; (3) uses and limitations of sediment concentration maps; and (4) the relation of stream sediment to the overall water pollution problem.

The author concluded that sedimentation of streams is becoming an increasingly important problem as the United States seeks full utilization of its water resources. Wise management of water supplies must take into account: The mode of occurrence and frequency of sediment discharge; the economic implications of soil loss, cost of treatment, and land erosion; the effect of urban development on stream sedimentation; and the impairment of water quality caused by sediment contributed to streams.

Although not generally regarded as a water pollution problem, stream sediments have significant effects on aquatic life and on water quality. They should be among the factors considered in plans for use and enhancement of the country's water resources.

Geol. Survey, U.S. Dept. Int., Washington, D.C., 20405

11. Jopling, A. V. LABORATORY STUDY OF SORTING PROCESSES RELATED TO FLOW SEPARATION. J. Geophysical Res. 69(16): 3403-3418. 1964.

The sorting processes responsible for the development of bedding in cross-bedded deposits were studied in a small laboratory flume. Flow separation over the foreset slope of the deposit is the primary factor responsible for the dispersion and sorting of the various grain sizes. Important sorting processes include selective transport due to differential settling velocity, pulsatory movement of particles, and dispersive pressure. The bedded structure in a foreset deposit characteristically reflects the segregation of grain sizes that occurs along the topset (backset) deposit. The reworking of the foreset slope by fluid turbulence causes small variations in grain fabric and packing that may accentuate the definition of the cross-bedded structure.

Harvard U., Cambridge, Mass., 02138

Engineering Design

See Also 3, 7, 11, 19, 20, 21, 22, 23, 24, 25, 27, 43, 45, 49, 58, 156.

12. Donnelly, C. A. TESTS OF A SPLITTER-TYPE ANTIVORTEX WALL FOR A HOOD DROP INLET TO A CLOSED CONDUIT SPILLWAY. U.S. Dept. Agr., Agr. Res. Serv. ARS 41-92, 4 pp. 1964.

Tests were reported on a hood drop inlet 2D square by slightly more than 2D deep, to determine the minimum height of splitter-type antivortex wall required to prevent vortices from affecting the spillway capacity. The tests showed that the top of the splitter wall above the crest of the drop inlet must be at least 1D. (D is the diameter of the barrel.)

The hood drop inlet was described and illustrated.

SWCRD, ARS, USDA, PIS, Beltsville, Md., 20705

13. Outmans, H. D. DUPUIT'S FORMULA GENERALIZED FOR HETEROGENEOUS AQUIFERS. J. Geophys. Res. 69(16): 3383-3386. 1964.

Dupuit's formula for the discharge from a well in a homogeneous aquifer was generalized for aquifers with horizontal or vertical layers of different thickness and conductivity and also for aquifers in which the conductivity varies continuously with the depth.

Union Oil Co. Calif., Brea, Calif.

14. Holtan, H. N., and Overton, D. E. STORAGE-FLOW HYSTERESIS IN HYDROGRAPH SYNTHESIS. J. Hydrol. 2: 309-323. 1964.

A technique was presented for using successive routings through partial storage as a means of inducing lag into the storage-flow relationship. By this means, the more stable storage indication of the recession can be applied in computing the rising limb of the hydrograph. Analytical solutions were presented for the case of steady rainfall on watersheds having linear storage indications for use in computing instantaneous rates of outflow. Techniques were also presented for numerical solutions in cases of variable rainfall or nonlinear storage-flow relations. These solutions eliminate the necessity for computing numerous incremental hydrographs and summating to obtain the complex storm hydrograph.

U.S. Hydrol. Lab., SWCRD, ARS, USDA, Beltsville, Md., 20705

15. Bouwer, H. RESISTANCE NETWORK ANALOGS FOR SOLVING GROUND-WATER PROBLEMS. Natl. Water Well Assoc. J. "GROUND WATER" 2(3): 26-32. July 1964.

Resistance network analogs (R-analogs) permit solution of ground water flow systems in media that may be uniform or nonuniform, isotropic or anisotropic, and saturated or unsaturated. Two-dimensional as well as axisymmetric systems can be represented on the analog, and complex boundary conditions can easily be simulated. Only steady-state systems can be analyzed with the R-analog. However, systems with moving water tables whereby the rate of movement of the water table is controlled by the flow system below the water table can be solved as a succession of steady states.

To capitalize on the special feature of R-analogs, i.e. essentially unlimited opportunity for control of the resistance between any two nodes, use of calibrated variable resistors is desirable. R-analogs are specially adapted to obtain solutions of individual flow systems, of which a vertical cross section is simulated on the analog.

In the analog model, resistances are inversely proportional to hydraulic conductivities or transmissibilities, electric current rates are proportional to rates of water flow, and electric potentials are proportional to the sum of pressure head and elevation head. R-analogs may be used to analyze: The flow system of a pumped well; a ground water recharge facility; a series of parallel drains; a seeping dam; a surface stream feeding the ground water; etc.

Examples were presented of flow problems involving free-surface development, simultaneous occurrence of saturated and unsaturated parts of the medium, moving water tables, and determination of transmissibility distribution and safe yield of ground water basins. The application of R-analogs in developing realistic cause-and-effect relationships for use with resistance-capacitance analog models of entire ground water basins was discussed and exemplified.

SWCRD, ARS, USDA, Tempe, Ariz., 85281

Ground Water Recharge

16. Schiff, L. GROUND-WATER RECHARGE HYDROLOGY. Natl. Water Well Assoc. J. "Ground Water" 2(3): [5 pp.] July 1964.

The hydrology of ground water recharge depends upon the physical and chemical characteristics of both soil and water. These characteristics must be measured and related to subsurface storage space and water movements, to determine the feasibility of a site for recharge and to select appropriate methods and systems of recharge. Then water may be efficiently stored underground to be used independently or conjunctively with releases from surface storage reservoirs.

SWCRD, ARS, USDA, Fresno, Calif., 93726

Irrigation

See Also 89, 93, 100, 147, 154, 158, 173, 212, 214, 249, 299, 318, 327, 370.

17. Wolfe, J. W., and Evans, D. D. DEVELOPMENT OF A DIRECT-READING EVAPORATION PAN FOR SCHEDULING PASTURE IRRIGATION. Oreg. Agr. Expt. Sta. Tech. B. 75, 31 pp. 1964.

A number of evaporative devices were correlated with consumptive use of pasture during a 3-year study on shaded plots. The highest correlation was obtained from an oven pan; that is, a pan with a glassed-in air space on one edge to trap more solar radiation. This pan had an evaporation rate equal to consumptive use.

The oven pan was redesigned for use as a direct-scheduling device for pasture irrigation. It was reduced from a 22.4-inch square to a 12-inch square, and its depth was increased from 2 to 8 inches. The 8-inch depth corresponded to the approximate available moisture-holding capacity of the soil within the root zone. A protective cage was placed around it with a screen over the top. It was designed to catch 1-inch for each inch of consumptive use of pasture. It is initially filled and placed in the field when the soil is at field capacity. Thus, each inch deficit in the pan represents an inch deficit in soil moisture. For many crops, irrigation should commence before the pan is half empty and should cease just before the pan overflows.

The redesigned oven pan was used successfully for scheduling pasture irrigation. It could be adapted to use for other perennial crops by selecting the size of the oven and the depth of pan to fit the crop and soil, respectively. When used with annual crops, the oven pan might result in over-irrigation in the spring if designed for the period of peak use, but slight over-irrigation at that time might not be too objectionable. If used for orchards, the oven pan would have to be placed with full exposure to the sun, not under a tree.

The principal advantage of the oven pan as a scheduling device is that it is labor saving. It is sufficiently accurate unless the crop receives a significant portion of its water from a water table. The oven pan indicates when to irrigate, how much water to apply, and when to stop irrigating. It would lend itself to automatic scheduling of solid coverage systems.

Tables, graphs, and photographs.

Agr. Expt. Sta., Oreg. State U., Corvallis, Oreg., 97331

18. Shull, H. AN INFLOW-ADVANCE-STORAGE METHOD FOR DETERMINING INFILTRATION IN IRRIGATED FURROWS. Soil Sci. 98(3): 192-196. 1964.

A procedure for developing a furrow infiltration equation from inflow-advance-storage data was described. Such a procedure may be of value in comprehensive research studies where accurate information on furrow infiltration is needed, and as a method for evaluating the accuracy of simpler instruments for measuring furrow infiltration. The procedure has the advantage of including data from the entire wetted furrow length. The accuracy of the resulting infiltration equation should be better than that of equations developed from infiltrometer or inflow-outflow data when suitable rate of advance and infiltration equations are chosen.

SWCRD, ARS, USDA, Brawley, Calif., 92227

19. Soil Conservation Service. SCS NATIONAL ENGINEERING HANDBOOK: SECTION 8; ENGINEERING GEOLOGY—CHAPTERS 3-7. irr. pp. $0.40. 1963.

20. Soil Conservation Service. SCS NATIONAL ENGINEERING HANDBOOK: SECTION 15; IRRIGATION—CHAPTER 1. SOIL-PLANT-WATER RELATIONSHIPS. 72 pp. $0.45. 1964.

21. Soil Conservation Service. SCS NATIONAL ENGINEERING HANDBOOK: SECTION 15; IRRIGATION—CHAPTER 8. IRRIGATION PUMPING PLANTS. 70 pp. $0.45. 1959.

22. Soil Conservation Service. SCS NATIONAL ENGINEERING HANDBOOK: SECTION 15; IRRIGATION—CHAPTER 9. MEASUREMENT OF IRRIGATION WATER. 70 pp. $0.45. 1962.

23. Soil Conservation Service. SCS NATIONAL ENGINEERING HANDBOOK: SECTION 15; IRRIGATION—CHAPTER 11. SPRINKLER IRRIGATION. 83 pp. $0.55. 1960.

24. Soil Conservation Service. SCS NATIONAL ENGINEERING HANDBOOK: SECTION 15; IRRIGATION—CHAPTER 12. LAND LEVELING. 59 pp. $0.60. 1961.

25. Soil Conservation Service. SCS NATIONAL ENGINEERING HANDBOOK: SECTION 16; DRAINAGE—CHAPTER 1. PRINCIPLES OF DRAINAGE. 31 pp. $0.35. 1961.

The Soil Conservation Service National Engineering Handbook is intended primarily for Soil Conservation Service (SCS) personnel. However, engineers and geologists working in related fields will find much of the information presented useful to them also.

The handbook is being published in sections, each section dealing with one of the many phases of engineering included in the soil and water conservation program. For easy handling, some of the sections are being published by chapters.

For sale by Supt. Doc., Govt. Print. Off., Washington, D.C., 20402

26. Hantush, M. S. DRAWDOWN AROUND WELLS OF VARIABLE DISCHARGE. J. Geophys. Res. 69(20): 4221-4235. 1964.

The discharge of an uncontrolled pumping well generally decreases with time. Eventually the discharge may attain a constant rate. Frequently, the observed discharge-time variation can be represented empirically by an algebraic equation of simple form.

Drawdown formulas were obtained for wells operating in leaky or nonleaky, effectively infinite aquifers, having three types of probable discharge-time variation. These formulas were expressed either in terms of already known and extensively tabulated functions or in terms of functions that can easily be tabulated for practical ranges of the parameters involved. Use of these formulas in the analysis of pumping-test data were discussed.

N. Mex. Inst. Mining and Tech., Socorro, N. Mex., 87801

27. Thornton, J. F., and Beasley, R. P. CHARACTERISTICS OF FLOW IN TRAPEZOIDAL AND TRIANGULAR IRRIGATION FURROWS. Mo. Agr. Expt. Sta. Res. B. 855, 36 pp. 1964.

A study was made of characteristics of flow in irrigation furrows, as influenced by furrow shape, roughness, slope, and rate of flow. Hydraulic tests were conducted in a flume 30 feet long, 3.33 feet wide, and 1.66 feet deep. Furrows with trapezoidal and triangular shapes were formed in the flume. Tests were run on four different roughnesses, using five rates of flow and six slopes. The furrows were constructed of aluminum and lined with silt or sand to provide different degrees of roughness. Additional tests were run, using furrows of the above-mentioned shapes formed in soil. During one series of tests, water was removed from the soil by a vacuum system to maintain infiltration. Another series was run without infiltration. Tests on furrows in soil were also run with five rates of flow and six slopes.

Data from the hydraulic tests were analyzed to determine the relationship between the roughness coefficient and the following variables: (1) Velocity; (2) depth; (3) hydraulic radius; and (4) Reynolds number. The results were presented graphically.

Results of the investigation indicated that:

1. The roughness coefficient was a function of the velocity, depth, hydraulic radius, and Reynolds number. The roughness coefficient decreased with an increase in each of these four variables.
2. The roughness coefficient was higher for the trapezoidal furrow than for the triangular furrow with the same rate of flow, degree of roughness, and slope.
3. The Reynolds number was three to eight times higher for the triangular furrow than for the trapezoidal furrow with the same rate of flow, degree of roughness, and slope.
4. The average infiltration rate was 0.12 inch per hour for the trapezoidal furrow and 0.87 inch per hour for the triangular furrow.

U. Mo., Col. Agr., Agr. Expt. Sta., Columbia, Mo., 65202

28. Bryan, B. B., and Baker, G. SMALL-DIAMETER PLASTIC PIPE FOR USE IN SUBIRRIGATION. Ark. Farm Res. 8(6): 7. 1964.

During the past 2 years, subirrigation has been studied on cotton by agricultural engineers in Arkansas on a pilot basis at the Delta Substation. In subirrigation, water is distributed in perforated, small-diameter plastic pipe under low pressure.

In 1963, seedbed preparation was accomplished by rebedding. Subsequent planting and cultural operations, including starting of irrigation, were normal. Two irrigations were made at pressures of 10 and 5 pounds per square inch. Each application was stopped when free water was visible on the surface of the row.

In 1964, the inaccuracies encountered in normal seedbed preparation by bedding resulted in the location of four of the six lengths of pipe immediately below furrows instead of rows. Normal planting and cultural practices again were followed.

Evaluation was made on the basis of increased yield from irrigation, uniformity of yield within the irrigated area, and notations of malfunctions of the equipment.

The data are presented in the following table:

Cotton Yields in the Study

Replication	Not irrigated	Sub-irrigated
	Lb. seedcotton per acre	
I	874	1,636
II	890	1,384
III	754	1,307
IV	1,124	2,458
V	1,105	1,703
VI	746	1,536
Mean	916	1,665
Increase from irrigation	-	749

Many engineering problems must be solved before subirrigation can be recommended generally for agricultural uses. It does have promise for adaptability to a completely automated irrigation system, including the distribution of fertilizer, soil fumigants, and systemic materials.

Agr. Expt. Sta., U. Ark., Fayetteville, Ark., 72701

29. Pugh, W. J., and Evans, N. A. WEED SEED AND TRASH SCREENS. Colo. Agr. Expt. Sta. B. 522-S, 18 pp. 1964.

Weed control is an important part of farm management. The most successful manager makes intensive use of herbicides, modern farm equipment for weed control, weed-free seed, and special cultural practices to control weeds. He should not overlook the weed seeds that may be carried in irrigation water.

Removal of small weed seeds from irrigation water is difficult but can be accomplished with proper screen devices that have the following features:

1. Screen frame should be sturdy enough to be removed frequently for cleaning. Steel pipe, angle iron, or 2" X 4" lumber all work well.
2. When the fine mesh screens (40 to 60) are used, a one-half-inch hardware cloth screen should be used as a support screen.
3. The fine mesh screen may be metal, fiber glass, or plastic. Plastic screens have proven satisfactory and did not corrode as rapidly as metal screens.

Various type screens were described and illustrated.

Tables and photographs.

Agr. Expt. Sta., Colo. State U., Fort Collins, Colo., 80521

30. Sale, P. J. M., and Harrison, D. J. SEEDLING EMERGENCE AS AFFECTED BY SOIL CAPPING. J. Hort. Sci. 39: 147-161. 1964.

The effect of irrigating a seedbed after sowing was compared with the effect of irrigating before the final cultivation and sowing. The total numbers emerged and the rate of emergence of lettuce, spinach, and beets were reduced if the soil surface was capped by post-sowing irrigation and the cap then dried out; a wet cap did not affect emergence.

Post-sowing irrigation with small drops, which caused little or no soil capping, tended to increase seedling emergence, compared with pre-sowing irrigation when the sowing depth was 1/2 inch or 1 inch.

When lettuce was sown at 1/4 inch depth, pre-sowing irrigation gave poor emergence because of rapid drying of the soil around the seed before it could germinate; post-sowing irrigation with small drops resulted in good emergence. Post-sowing irrigation with large drops gave good emergence if the resulting cap was broken by light cultivation as soon as it dried.

Natl. Veg. Res. Sta., Wellesbourne, Warwick, England.

31. Smith, S. C., and Brewer, M. F. CALIFORNIA'S MAN-MADE RIVERS. J. Soil and Water Conserv. 19(5): 191-193. 1964.

Rapid growth of population, of irrigated agriculture, and of the industrial complex in California has created burgeoning demands for water. To satisfy these needs and to provide for future growth, massive projects for water development and transfer are being undertaken. The planned physical facilities and arrangements for financing them were described.

Colo. State U., Fort Collins, Colo., 80521

32. Tyler, C. L., Corey, G. L., and Swarner, L. R. EVALUATING WATER USE ON A NEW IRRIGATION PROJECT. Idaho Agr. Expt. Sta. Res. B. 62, 24 pp. 1964.

The use of irrigation water on an irrigation project was evaluated over a 5-year period. Irrigation efficiencies were determined, and an attempt was made to correlate efficiency with several measured variables.

Three areas comprising a total of 40 farm units with 4,340 irrigable acres were studied. Approximately 93 percent of the irrigable area was actually cropped. The 5-year average of farm delivery was 3.18 acre-feet per cropped acre. The crops consumptively used an average of 1.57 acre-feet, runoff accounted for an average of 0.59 acre-feet per cropped acre. The average of 1.02 acre-feet per cropped acre unaccounted for was considered to be losses due to deep percolation, conveyance, and late fall irrigations. The irrigation efficiencies ranged from 42.4 percent in 1958 to 54.8 percent in 1961. The average for the period was 49.6 percent.

Although several factors which affect irrigation efficiency were measured and analyzed, there was a great deal of variance in efficiency unaccounted for. Of those items measured, the yield index was the best predictor of efficiency.

The type of crops grown had a significant effect on efficiency, with a high percentage of forage and grain crops resulting in a higher efficiency. Consumptive use was not actually measured but was calculated from climatological data. Therefore, high irrigation efficiencies did not necessarily mean good irrigation practices.

The length of head ditch per acre had a significant effect on efficiency. Length of head ditch is related to land slopes and field arrangements and a minimum of head ditch indicates a well-designed irrigation system.

Even though several factors were measured, only approximately one-fourth of the variance in efficiency was accounted for by these factors.

Approximately 20 percent of the water delivered to the farms in this study was lost as field runoff.

U. Idaho, Col. Agr., Agr. Expt. Sta., Moscow, Idaho, 83843

33. Handa, B. K. MODIFIED CLASSIFICATION PROCEDURE FOR RATING IRRIGATION WATERS. Soil Sci. 98(4): 264-269. 1964.

The classification system recommended by the United States Salinity Laboratory was modified to increase its usefulness and to give an idea of the gypsum requirements of irrigation waters with high sodium hazards. The modified system was described.

Soil Res. Lab., Calcutta, India.

34. Matson, A. L. SOME FACTORS AFFECTING THE YIELD RESPONSE OF SOYBEANS TO IRRIGATION. Agron. J. 56(6): 552-555. 1964.

Selected factors suspected of affecting yield responses of soybeans to irrigation were studied in an experiment in southeast Missouri on Dexter sandy loam during the years 1956, 1957, and 1959. The variables included three water regimes, three dates of planting, three varieties, two fertilizer treatments, and two plant spacings. The experiment did not indicate any combination of factors which might be used to obtain irrigation responses comparable to those obtained from cotton or corn. No combination of factors used produced what would be considered unusual yields for this area, although yield increases up to 30 bushels per acre above the yields of non-irrigated plots were obtained.

The following conclusions were reached concerning irrigation: (1) Yields were not greatly reduced by withholding irrigation until plants began to bloom and by discontinuing irrigation 1 month before harvest; (2) with irrigation, highest yields were obtained by planting a full season variety during the middle of May; (3) when planted in 40-inch rows, 1-1/2 inch plant spacings within the row produced somewhat higher yields than did 3-inch spacings; and (4) the application of 26 pounds of phosphorus and 50 pounds of potassium per acre on soil of this type did not increase soybean yields.

U. Mo., Agr. Expt. Sta., Columbia, Mo., 65202

35. Doss, B. D., Ashley, D. A., and Bennett, O. L. EFFECT OF MOISTURE REGIME AND STAGE OF PLANT GROWTH ON MOISTURE USE BY COTTON. Soil Sci. 98(3): 156-161. 1964.

The effect of soil moisture regime and stage of plant growth on the rate of water used by cotton was determined on a Greenville fine sandy loam soil at Thorsby, Ala., during the 1958 and 1959 growing seasons. The three soil moisture regimes were: M_1 no irrigation; and M_2 and M_3 supplemental irrigation when 80 percent and 30 percent, respectively, of the available soil moisture had been removed from the surface 24 inches of soil. Soil fertility was maintained at a high level at all soil moisture regimes.

The rate of moisture use was dependent on available soil moisture and stage of plant growth. Rate of moisture use increased as the amount of available soil moisture increased. The average rate was generally low in the spring while the plants were small, gradually increased until a maximum rate was reached during the period of blooming and boll development, and then gradually decreased until bolls opened. Maximum moisture-use rates ranged as high as 0.35 inch per day, with average daily rates ranging from 0.11 to 0.24 inch, depending upon period of growth and soil moisture regime.

SWCRD, ARS, USDA, Thorsby, Ala., 35171

36. Brown, A. R., Cobb, C., and Wood, E. H. EFFECTS OF IRRIGATION AND ROW SPACING ON GRAIN SORGHUM IN THE PIEDMONT. Agron. J. 56(5): 506-509. 1964.

The effects of three levels of irrigation and 2 row spacings on the agronomic characters of two grain sorghum hybrids were studied in 1959, 1960, and 1962. All plots were adequately fertilized so that fertility was not a limiting factor. Conclusions were as follows:

1. Grain yields of hybrid grain sorghum were increased by irrigation.
2. Irrigation when 10 percent available moisture remained in top 2 feet of soil was as effective in increasing grain yields as irrigation when 50 percent available moisture remained in top 2 feet of soil.

3. Hybrids grown in 20-inch row spacings produced significantly more grain than hybrids grown in 40-inch row spacings, in 2 out of 3 years.
4. Hybrids grown in 20-inch row spacings yielded more forage per acre than hybrids grown in 40-inch row spacings. Irrigation produced significantly more forage in 1 year out of 3.
5. Irrigation had no effect on rate of growth (height in inches) in 1959, a year when rainfall was adequate for the first 50 days after emergence. In 1960 and 1962, growth rate was increased by irrigation.
6. Weight per bushel was higher in the 40-inch row spacing than in the 20-inch row spacing when anthracnose was absent. Date of one-half bloom occurred earlier in the 40-inch rows than in the 20-inch rows, particularly in the nonirrigated plots. Head exsertion was increased by irrigation. Plants lodged more in the 20-inch rows than in the 40-inch rows, particularly under drought conditions. When charcoal rot was prevalent, irrigation reduced lodging induced by this disease.
7. The average daily rate of moisture use was higher with irrigation than without, but there was no difference between the low and high levels of irrigation. There was no difference in the moisture use rate between the 20-inch and 40-inch rows.

Col. Expt. Sta., U. Ga. Col. Agr., Athens, Ga., 30601

37. Doss, B. D., Ashley, D. A., Bennett, O. L., Patterson, R. M., and Ensminger, L. E. YIELD, NITROGEN CONTENT, AND WATER USE OF SART SORGHUM. Agron. J. 56(6): 589-592. 1964.

The effects of three soil moisture regimes and five rates of nitrogen on forage yield, nitrogen content, and water use of Sart sorghum were determined on a Greenville fine sandy loam soil during the 1960-61 growing seasons. The three soil moisture regimes were: M_1 rainfall only; and M_2 and M_3 supplemental irrigation when 80 and 30 percent, respectively, of the available soil moisture had been removed from the surface 24 inches of soil. The five rates of nitrogen from ammonium nitrate were 0, 75, 150, 300, and 450 pounds per acre.

Average yields for the 2-year period increased as available soil moisture increased. The largest yield response to nitrogen was for the first increment and this response was greater at the higher levels of moisture. Average yields ranged from 6.41 tons of ovendry forage per acre with no nitrogen at the M_1 moisture regime, to 12.35 tons with the 450-pound nitrogen rate at the M_3 moisture regime.

Closer row spacing at the 300-pound nitrogen rate increased dry forage yields by approximately 1.75 tons per acre at all soil moisture regimes. Reducing the row spacing to 18 inches was more effective than increasing the nitrogen rate, and almost as effective as increasing the next increment of irrigation.

In general, nitrogen content of the plants varied inversely with soil moisture and directly with rate of nitrogen. Closer row spacing increased the nitrogen content of forage an average of 0.10 percent N at the M_2 and M_3 moisture regimes.

The rate of water use varied directly with the amount of available soil moisture. Average daily rates were 0.11, 0.13, and 0.17 inch for the M_1, M_2, and M_3 moisture regimes, respectively.

SWCRD, ARS, USDA, Thorsby, Ala., 35171

38. Rogler, G. A., and Lorenz, R. J. SEED AND FORAGE PRODUCTION OF IRRIGATED RUSSIAN WILDRYE AS INFLUENCED BY TIME AND RATE OF NITROGEN FERTILIZATION. Agron. J. 56(5): 501-503. 1964.

Seed fertilizer treatments of N and P were applied to 3-foot rows of irrigated Russian wildrye over a 7-year period. Rates of N were 0, 50, 100, and 200 lb./A. applied annually. N was applied in the fall in all cases. Two of the treatments were split applications of 100-N applied fall and spring and summer and fall. The 200-N rate was applied as a split application in the spring and fall. P was applied at seeding time only in all treatments except with one single application of 100-N and in the no fertilizer treatment.

The first significant differences in seed yields due to N were obtained the fourth crop year. Seven-year average yields ranged from 163 lb./A. for the 0-N treatment to 291 pounds for the 200-N treatment. Each added increment of N produced an increase in yield. Yields from the 0-N treatment decreased rapidly as stands increased in age.

No significant relations were indicated between bushel weight and weight of 200 seeds or between weight of 200 seeds and seed yield.

Response to N in increased forage aftermath yields after seed harvest was obtained from the third through all 7 years of the study. Average yields ranged from 1.92 tons per acre for the 0-N treatment to 3.50 tons for the 200-N treatment. Average yields increased with each added increment of N. Forage yields were closely correlated with seed yields. The application of N sustained both seed and forage yields at a much higher level than no N as stands became older.

Protein content of the forage immediately after seed harvest ranged from 9.13 to 18.88 percent. Forage regrowth ranged from 18.75 to 25.25 percent.

There were no significant differences in seed and forage yields between single and split applications of N and no yield response to P.

CRD, ARS, USDA, Mandan, N. Dak., 58554

39. Smith, F. W. FERTILIZER SOLUTIONS AND IRRIGATION IN KANSAS. Fert. Solutions. 6(4): 6-8, 11-12. 1964.

Irrigated Kansas soils usually need nitrogen. Amount needed varies considerably, depending on the crop under production, soil texture, geographical location in the state, and other factors. Phosphorus is widely needed in irrigated areas.

Most irrigated Kansas soils, except the sandy ones, are well supplied with exchangeable potassium. Sandy loams and loamy sands tend to be low in exchangeable potassium. Because of these tendencies, irrigated sandy soils likely will need potash fertilizer.

Trace element deficiencies also may prevail in irrigated areas. Chlorosis caused by iron deficiency occurs in much of Western Kansas. Iron deficiencies are most severe in southwestern Kansas. Iron deficiency affects the sorghum crops much more than other common farm crops. Zinc deficiencies have been noted at numerous Kansas locations. These occur most commonly and most prominently on newly "cut" land which has only recently been leveled for irrigation. Milder deficiencies may prevail on undisturbed land.

Nitrogen Suggestions for Irrigated Crop
Production in Kansas

Crop	Lbs. of Nitrogen (N) to Apply per Acre per Crop year
Small grains	40 to 60
Corn	120 to 200
Grain sorghum	100 to 160
Forage sorghum	100 to 160
Sugar beets	80 to 120
Cool season grasses	100 to 120
Castor beans	50 to 100

Kans. State U., Manhattan, Kans., 66504

40. Long, R. B. PUMP IRRIGATION COSTS, ROOSEVELT COUNTY, NEW MEXICO. N. Mex. Agr. Expt. Sta. Res. Rpt. 101, 8 pp. 1964.

A study was given of costs of pumping irrigation water in northeastern Roosevelt County, N. Mex. Although land in the area was irrigated as early as 1910, rapid growth of irrigation began in 1934. Cotton, peanuts, and sorghum are the major crops grown on this irrigated land.

Information was given on about 35 wells located on 20 farms. Irrigation practices were noted to be quite uniform throughout the valley. Each well irrigated an average of about 40 acres, and on larger farms three or four wells were often joined together by an enclosed water distribution system. Farmers pumped an average of 2.2 acre-feet of water per acre. Pump yields averaged 600 gallons per minute.

Wells are quite shallow, average about 109 feet in depth. Shallow wells and lifts require relatively small investments, varying from $3,000 to $4,700 and averaging $3,600 for the well, casing, pump, motor, and accessories.

Annual per acre-foot pumping costs averaged $8.04 for the 35 wells. Costs per acre-foot for all electric plants averaged $8.11, and for all butane plants the average cost was $8.16. Wells that pumped from 0 to 50 acre-feet of water had average per acre-foot costs of $17.55, while wells that pumped 150 or more acre-feet had average per acre-foot costs of $5.88.

When as much water was pumped with an electric pump as with a butane pump, costs dropped to $6.39 per acre-foot. Total fixed costs were higher for butane plants than for electric plants, because of the higher investments involved. The average annual costs of all plants were $811.22.

As the mining of the ground water resource in the area continues, pumping costs are expected to increase.

Agr. Expt. Sta., N. Mex. State U., State College, N. Mex., 88070

41. Long, R. B., and Stephens, W. P. PUMP IRRIGATION COSTS, CURRY COUNTY, NEW MEXICO. N. Mex. Agr. Expt. Sta. Res. Rpt. 100, 10 pp. 1964.

A study was given of pumping costs in Curry County, N. Mex. Wheat and sorghum are the two major crops grown on irrigated land. Irrigation in Curry County tends to be more supplemental than in other New Mexico counties because rainfall is adequate in some years. The annual precipitation averages from 16 to 18 inches, but droughts are common.

Pump irrigation water is not easily obtained in the Clovis area. Wells up to 500 feet deep and lifts averaging 300 feet are typical. Water quality is good, and pump yields average about 700 gallons per minute.

Deep wells and great lifts require large investments. Investments for the well, casing, pump, motor, and accessories varied from $8,600 to $23,700 and averaged about $13,300.

Annual per acre-foot pumping costs averaged $9.86 for the 38 study farms. Costs per acre-foot averaged $8.58, $12,86, and $13,68 for natural gas, butane, and diesel fuel, respectively. Natural gas, however, is not practical for all farms in Curry County because of the pipeline costs.

The average total cost per acre-foot was the lowest for plants pumping between 400 and 500 acre-feet per season.

Agr. Expt. Sta., N. Mex. State U., State College, N. Mex., 88070

42. Mann, F. L., Ellis, H. H., and Krausz, N. G. P. WATER-USE LAW IN ILLINOIS. Ill. Agr. Expt. Sta. B. 703, 332 pp. 1964.

A detailed report was given on water-use laws in Illinois.

The use of Illinois water resources for agricultural, industrial, municipal, and recreational purposes is rapidly increasing. As these resources become economically more important, the legal structure governing rights and responsibilities in utilizing and developing the State's water resources becomes more complex.

U. Ill., Agr. Expt. Sta., Urbana, Ill., 61803

Drainage

See Also 25, 93, 135, 138, 142, 212, 214, 233, 267, 364.

43. Dagan, G. LINEARIZED SOLUTION OF UNSTEADY DEEP FLOW TOWARD AN ARRAY OF HORIZONTAL DRAINS. J. Geophysical Res. 69(16): 3361-3369. 1964.

An approximate method for predicting water table fluctuations caused by a variable recharge was presented. It was assumed that the drains are at the water table and that the drained permeable stratum is deep, homogeneous, and isotropic. The main approximation of the flow system is the linearization of the boundary condition on the free surface. In this way the problem is reduced to the solution of a Volterra integral equation of the first kind, which is solved by a numerical technique. The results were presented in a dimensionless form in tables and graphs.

Hydraul. Lab., Technion, Israel Inst. Tech., Haifa, Israel.

44. Troeh, F. R. LANDFORM PARAMETERS CORRELATED TO SOIL DRAINAGE. Soil Sci. Soc. Amer. Proc. 28(6): 808-812. 1964.

Quantitative means of describing land surfaces were developed and related to soil drainage. Hundreds of elevations were determined on each of 40 plots representing 6 soil series. The 3-dimensional equations developed to approximate these elevations assumed radial symmetry and a parabolic relationship between elevation and distance from the symmetry axis. An electronic computer was used to solve and test equations for several positions in each plot. Areas that crossed soil boundaries were excluded. The equations of 75 percent of the remaining positions closely approximated the data and were used in this study.

Parameters representing slope, rate of change of slope, and radius of curvature were obtained from the equations. These parameters were used to classify the shapes of the land surfaces both qualitatively and quantitatively. Three-dimensional plots of these parameters correctly predicted the drainage class of 90 percent of the positions with usable equations. Surfaces having equivalent drainage at all points were defined by equations in terms of radius, slope, and rate of change of slope.

Iowa State U., Ames, Iowa, 50010

45. Kirkham, D. PHYSICAL ARTIFICES AND FORMULAS FOR APPROXIMATING WATER TABLE FALL IN TILE-DRAINED LAND. Soil Sci. Soc. Amer. Proc. 28(5): 585-590. 1964.

A physical model consisting of fictitious membrances and vertical strips placed along streamlines, or approximate streamlines, in the porous medium where sometimes gravel replaces part of the soil, provides a system that can be analyzed for the time of water table fall in tile-drained land.

Formulas for this system were derived and tested against field data. The theoretical formulas and experimental data showed, that for not too high water tables (when friction losses in the water table arch may be neglected), and for tiles running about half full, the water table will fall exponentially with time. Thus, extrapolating, on semilogarithmic paper, a graph of water-table height as measured above the level of the drain tiles centers vs. time, to later times, should yield water table depths for the later times. The formulas are approximate, but certain of the formulas, are on the "safe side" for use in drainage design since the water table heights given by or associated with the formulas are always higher—if only slightly higher—than are actual water tables in a porous medium devoid of the strips and membranes.

The formulas are for the fall of the water table after it has been established by steady rainfall. Nevertheless, it was shown that the formulas may be used for calculating water table fall after unsteady rains or intermittent recharge conditions as from irrigation water—if the height of the water table is not too high above the centers of the drain tubes and if the drain tubes are not too close to a barrier.

Agr. and Home Econ. Expt. Sta., Iowa State U. Sci. and Tech., Ames, Iowa, 50010

46. Fujioka, Y., and Kitamura, T. APPROXIMATE SOLUTION OF A VERTICAL DRAINAGE PROBLEM. J. Geophysical Res. 69(24): 5249-5255. 1964.

The water potential distribution in soils when the water is draining from a vertical soil column into the atmosphere was studied theoretically and experimentally. The two kinds of equations, for the quasi-steady state when ponded water on the soil surface is decreasing and for the nonsteady state when the water table disappears from the soil surface and is falling in the vertical soil column were analyzed in detail. There was good agreement between theory and experiment if some special assumptions were accepted. From such results the soil water near the water table was also discussed. The difference between the water in the so-called capillary zone and that under the water table could not be found.

Faculty Agr., Kyoto U., Kyoto, Japan.

47. List, E. J. THE STEADY FLOW OF PRECIPITATION TO AN INFINITE SERIES OF TILE DRAINS ABOVE AN IMPERVIOUS LAYER. J. Geophys. Res. 69(16): 3371-3381. 1964.

A solution was given to the problem of the steady flow of precipitation to an infinite series of tile drains above an impervious layer. The free surface boundary conditions were exactly satisfied, but the shape of the impervious layer was approximated. Capillary forces were neglected. The theoretical results were compared with limited field measurements, and good agreement was found. The solutions became less accurate when the drains were very close to the impervious layer. The limiting cases were shown.

U. Auckland, Auckland, New Zealand.

48. Hoffman, G. J., and Schwab, G. O. TILE SPACING PREDICTION BASED ON DRAIN OUTFLOW. Trans. ASAE 7(4): 444-447. 1964.

Field measurements of tile flow and the water-table height midway between tile lines were taken following five irrigation periods during a 3-year period. The measurements were made on plots one-half acre in size. Four plots were surface-drained, and another four were level with no surface drainage. The soil was stratified and anisotropic, typical of the lakebed region in Ohio.

From the relationship between tile flow and the midplane water-table heights, the effective hydraulic conductivity was determined. Using these values, a procedure was developed for determining the tile spacing for various rates of water table drawdown using a theoretical equation developed for homogeneous soil. Surface drainage increased the permissible tile spacing at least 50 percent.

N.C. State Col., Raleigh, N.C., 27607

49. Benedict, R., Wait, J., Wilkes, W., and Harris, W. LAND GRADING AND LEVELING PROGRAMS FOR DIGITAL COMPUTERS. Ark. Agr. Expt. Sta. B. 691, 34 pp. 1964.

Warped surfaces designed by digital computers allow row grades and side slopes to vary within prescribed limits. These limits are: Maximum and minimum row grades; maximum and minimum side slopes; maximum change in row grade at a station; and maximum change in side slope at a station.

Such warped surface designs result in reduced yardages and lengths of haul, and associated benefits, as compared to plane surface designs. The associated benefits are less touchup after construction, and more rapid recovery from the adverse effects of construction as a result of reduced depths of cuts and fills.

A warped surface program was written for the IBM 650 digital computer. To facilitate programming, a design method was developed that allows designs to vary within prescribed limits. This program has one serious limitation—time requirements to complete individual rows when it is necessary to cut or fill for grade as for distances in excess of five stations allow an excessive buildup or error in the amount of cuts and fills.

A method of predesign was developed to control the buildup in error in the amount of cuts and fills. Three predesign programs were written for the IBM 650 digital computer. They vary in the use of the predesign information and in the punch-out method. The first predesign program goes directly into the warped surface program and a final warped surface design results. The second punches the predesign information in a form that can be read directly into the warped surface program as modified data. The third punches complete predesign information and should be useful in determining the limitations of the predesign technique.

A plane surface program was written for the IBM 650 digital computer that allows field data to be prepared using the same format and the same field size and shape limitations as with the warped surface program.

Agr. Expt. Sta., U. Ark., Fayetteville, Ark., 72701

Evaluation of Flood Water Damage

50. Ford, E. C. UPSTREAM FLOOD DAMAGE. J. Soil and Water Conserv. 19(6): 231-234. 1964.

Though infrequent, catastrophic floods that cause death and destruction throughout broad areas attract much attention, news media seldom headline the frequent floods that occur in small watersheds in all parts of the United States. Yet, the total yearly losses due to floods in headwaters areas in this country are greater than those suffered as a result of major rivers overflowing their banks. Estimates of the magnitude of annual upstream damage from floodwater and sediment were given in the table.

Table Estimated Average Annual Upstream Flood Damage in the Conterminous United States

TYPE OF DAMAGE	ANNUAL COST	PERCENT OF TOTAL COST
Crops and pasture	$ 459,512,000	44.9
Flood plain scour	34,972,000	3.4
Streambank erosion	7,083,000	0.7
Gully erosion	78,397,000	7.7
Other erosion	4,082,000	0.4
Other agricultural	77,606,000	7.6
Sediment	87,652,000	8.6
Nonagricultural	182,871,000	17.9
Indirect	90,377,000	8.8
TOTAL	$1,022,552,000	100.00

Watershed Planning Div., SCS, USDA, Washington, D.C., 20250

Storage and Conveyance

See Also 158, 159, 163, 164, 340.

51. Peters, J. C., and Alvord, W. MAN-MADE CHANNEL ALTERATIONS IN THIRTEEN MONTANA STREAMS AND RIVERS. Trans. North Amer. Wildlife and Natural Resources Conf. 29: 93-102. 1964.

There were 1,987 individual alterations in the 768 miles of stream channel inventoried in Montana. As a result of the man-made alterations, the length of the channels was shortened by 68 miles. Agricultural activities accounted for the greatest length of channel altered, followed in order by railroad construction, road construction, and urban and industrial development. Relocated channels accounted for the greatest length of channel altered, followed in order by riprapping, diking, and channel clearance.

Standing crops of game fish were several times more abundant in natural, meandering channels than in altered channels.

Mont. Fish and Game Dept., Helena, Mont., 59601

52. Crow, F. R., and Ree, W. O. DETERMINING THE EFFECT OF FARM PONDS ON RUNOFF FROM SMALL WATERSHEDS. Okla. State U. Expt. Sta. B. B-629, 14 pp. 1964.

Many interrelated factors determine the total effect of farm ponds on small watersheds. Among these are: Total area; number of ponds; individual and combined drainage areas of the ponds; geometry of the ponds; and ratio of pond drainage area to storage capacity.

The extent to which any given pond will affect watershed runoff depends on: (1) Available storage capacity of the pond at the beginning of the storm; and (2) amount of direct rainfall and runoff. The initial pond water level is an important consideration. It is impractical to measure all pond levels with stage recorders, an analytical procedure may be used for estimating the levels, with an occasional gage reading to serve as a check.

Procedures were developed for estimating runoff retained by: (1) A single pond on a watershed; and (2) multiple ponds on a given watershed. On the multiple pond watershed, the average reduction in total watershed runoff due to retention by ponds was 3.57 percent. During the 130 months when runoff was less than 1 inch per month, the average runoff retention was 8.19 percent. During the remaining 20 months the average runoff retention by ponds was 2.23 percent.

Although the pond drainage areas occupy 20 percent of the watershed, the runoff retained by the ponds was much less than that amount, even in extended dry periods.

Tables and maps.

Okla State U. Expt. Sta., Stillwater, Okla., 74075

53. Agronomy Department. EVAPORATION REDUCTION INVESTIGATION: PACTOLA RESERVOIR, SOUTH DAKOTA. S. Dak. Agr. Expt. Sta. Tech. B. 24, 153 pp. 1964.

Reservoir evaporation reduction with monomolecular film was investigated during the summers of 1962 and 1963 at Pactola Reservoir, S. Dak. In this cooperative study a material composed of hexadecanol and octadecanol was applied as a molten spray in 1962 and as a powder in 1963. The molten spray was dispensed from both fixed and mobile dispensing units, with the mobile unit being superior. The powder was also spread from a mobile unit. The average monolayer coverage during a 13-day period using moltent spray was 50 percent with a rate of 0.55 lb. acre^{-1} day^{-1}, while an average of 73 percent coverage was achieved during the 1963 98-day test, using the powdered material and a rate of 0.43 lb. acre^{-1} day^{-1} was used. Wind speed was the primary controlling factor in maintaining a monolayer. An average wind speed of 5.8 m.p.h. during the film treatment periods and the use of mobile dispensing units made it possible to achieve the high coverage.

The average evaporation reduction as calculated from the energy-budget, mass-transfer method gave an average reduction of 14 percent. A total of 215 acre-feet of water was saved, and the average cost per acre-foot of the water saved was $69. A constant of proportionality between the engergy-budget, mass-transfer method, and the simplified method was found to be 0.31.

The effect of the monolayer film on stored energy in the reservoir was discussed extensively. The water temperature data collected during 1963 showed that water temperatures to a depth of about 10 feet increased rapidly after commencement of the film treatment period. A possible continuing effect on stored energy due to the monolayer film was also considered.

A net radiometer for measuring net radiation over the water surface and a lithium chloride dew point senser used to measure vapor pressure of the air were compared with more commonly used methods for obtaining the respective values. Both units were found to check well with the comparative methods.

Tables, charts, and photographs.

Agr. Expt. Sta., S. Dak. State U., Brookings, S. Dak., 57007

BASIC SOIL SCIENCE

Soil Physics

See Also 17, 18, 27, 30, 45, 46, 53, 82, 83, 87, 96, 108, 122, 129, 140, 141, 168, 171, 178, 194, 212, 219, 222, 225, 233, 265, 290, 291.

54. Taylor, H. M., and Burnett, E. INFLUENCE OF SOIL STRENGTH ON THE ROOT-GROWTH HABITS OF PLANTS. Soil Sci. 98(3): 174-180. 1964.

Two field experiments were conducted to evaluate the mechanism that causes moist compacted Amarillo fine sandy loam soil to impede plant-root growth.

The results showed that it is soil strength, and no other physical factor of the soil, that controls growth of roots through this moist soil. Soil strengths, as measured with one specific penetrometer, of 25 to 30 bars at field capacity prevented root penetration through the soil mass, but roots grew through a soil layer with a strength at field capacity of about 19 bars. A few roots penetrated layers of 25 to 30 bars soil stength by following low-strength fissures or cracks.

There were no apparent differences among several species of plants in their ability to penetrate high-strength layers.

Southwestern Great Plains Res. Cent., Bushland, Tex., 79012

55. Taylor, H. M., Locke, L. F., and Box, J. E. PANS IN SOUTHERN GREAT PLAINS SOILS: III. THEIR EFFECTS ON YIELD OF COTTON AND GRAIN SORGHUM. Agron. J. 56(6): 542-545. 1964.

Experiments to determine effects of soil pan strengths on yield of cotton and grain sorghum were conducted at three locations in the Southern Great Plains.

Growth rate and yield of both cotton and grain sorghum were drastically reduced as soil pan strengths increased to 25 bars, but further strength increases about 25 bars did not reduce yield. Yields of cotton and grain sorghum from high-strength pans were about half of those from low-strength soil.

SWCRD, ARS, USDA, Bushland, Tex., 79012

56. Anderson, W. B., and Kemper, W. D. CORN GROWTH AS AFFECTED BY AGGREGATE STABILITY, SOIL TEMPERATURE, AND SOIL MOISTURE. Agron. J. 56(5): 453-456. 1964.

Three levels of aggregate stability were developed by varying degrees of mechanical destruction from a soil which had a naturally good aggregate stability. Corn plants were grown in each to determine the effect of aggregate stability on yield. The intermediate level of aggregate stability in which the soil structure had been partially destroyed gave the greatest yield of corn tops.

The rate of oxygen use by roots at three soil temperatures was measured in containers having the soil surface sealed with a thick layer of vaseline mixed with beeswax. Plants were intact during the study. Oxygen use rates were also measured on sealed containers without plant roots to obtain the oxygen use by soil microorganisms not associated with roots. Corn roots growing in conjunction with soil microorganisms continued to use oxygen at O_2 contents of less than 5 percent, whereas oxygen use by microorganisms appeared to stop at this level. Rate of oxygen use per cc. of roots was greatest at 30° C. when oxygen was about 17 percent, but the roots at 17° C. used oxygen faster at lower levels of oxygen. The data raised the question as to whether there may be a "luxury consumption" of oxygen by the plant roots at higher soil oxygen contents.

Colo. State U., Fort Collins, Colo., 80521

57. Fox, W. E. A STUDY OF BULK DENSITY AND WATER IN A SWELLING SOIL. Soil Sci. 98(5): 307-316. 1964.

The relation of bulk density and soil water in a swelling soil was examined. Bulk densities and associated moisture contents were measured for 0- to 3-inch and 6- to 9-inch depths for a range of moisture contents for the years 1956-60.

Mathematical models of swelling soils were devised for defined moisture ranges, based on the following assumptions: That swelling was either unidimensional (that is, in vertical direction only) or was three-dimensional and equidimensional; that air did not enter horizontal voids; and that swelling was normal (that is, change in soil volume equaled the change in soil moisture volume).

From a comparison of the changes predicted by the models with the changes measured in a field soil in the 0- to 3-inch and 6- to 9-inch layers, it was found that: (1) Swelling for soils wetter than wilting point was normal; (2) within this moisture range, two types of volume change occurred—a unidimensional phase, and a three-dimensional equidimensional phase—which were separated by a fairly distinct moisture point (46 percent gravimetric in the soil examined); and (3) there were no stable voids in the soil which lost water in either phase, and the soil had no field capacity as normally defined.

The effect of these findings on pedology and on agronomic and foundation studies was discussed.

U. Queensland, St. Lucia, Brisbane, Queensland, Australia.

58. McHenry, J. R., and Dendy, F. E. MEASUREMENT OF SEDIMENT DENSITY BY ATTENUATION OF TRANSMITTED GAMMA RAYS. Soil Sci. Soc. Amer. Proc. 28(6): 817-822. 1964.

The measurement of density by observing the attenuation of transmitted gamma rays was adepted to the measurement of sediment density. A dual probe, utilizing transmission techniques, was evaluated for use in measuring the density of sediments collected from runoff of plots or small watersheds. The equipment consists of a 7-mc. cesium -137 source placed in one access tube and a probe containing a NaI scintillation crystal, photomultiplier tube, and preamplifier in the second tube. The high-voltage power supply and scaler ratemeter for readout are supplied in a portable unit powered by silver-cadmium rechargeable dry cells Cesium -137 gamma radiation is measured by employing electronic discrimination to eliminate all photons of energies below about 0.65 Mev.

Sediment densities were measured in silt boxes installed on a small watershed at Holly Springs, Miss., following laboratory calibration tests. The dual probe employed measured densities of sediments to within 0.01 absolute density units. The vertical resolution of the apparatus is less than 1 inch, so that density measurements of thin layers and of materials at interfaces can be made. In one field test, sediment weights, of the order of 8,500 pounds, computed for a silt box on the basis of dual probe density determinations varied less than 1 percent from a gravimetric determination. Changes in sediment density with time, with additional increments of sediment, and with storms were effectively measured.

Sedimentation Lab., SWCRD, ARS, USDA, Oxford, Miss., 38655

59. Buol, S. W. CALCULATED ACTUAL AND POTENTIAL EVAPOTRANSPIRATION IN ARIZONA. Ariz. Agr. Expt. Sta. Tech. B. 162, 48 pp. 1964.

The Thornthwaite (1948) formulas as incorporated in the nomograms by Palmer-Havens (1958) were used to calculate actual and potential evapotranspiration. Annual potential and potential evapotranspiration for the 32° F. frost-free season, along with actual annual 32° F. frost-free season, 28° F. frost-free season, and 24° F. frost-free season values, were computed for 61 weather stations in Arizona.

Isograms of the calculated annual actual and potential evapotranspiration and the 32° F. frost-free season actual and potential evapotranspiration values were plotted for all the stations calculated to show statewide distribution.

The calculated values as well as potential evapotranspiration values for an additional 101 stations computed by Hutchings (1954) for which inadequate frost-free existed were given in the appendix.

Areas of the State in which climatically it is possible to grow various crops and give parameters of meteorological measurements for comparison to the distribution of natural vegetation were shown by maps.

Agr. Expt. Sta., U. Ariz., Tucson, Ariz., 85721

60. Doss, B. D., Bennett, O. L., and Ashley, D. A. MOISTURE USE BY FORAGE SPECIES AS RELATED TO PAN EVAPORATION AND NET RADIATION. Soil Sci. 98(5): 322-327. 1964.

Moisture-use rates were determined for alfalfa, coastal bermudagrass, and sorghum on Greenville fine sandy loam at Thorsby, Ala. These rates varied with: Season of year; available soil moisture; stage of plant growth; and species.

Moisture-use rates determined from gravimetric soil sampling throughout the growing season for each species were correlated separately with open pan evaporation and the evapotranspiration equivalent of net radiation. These correlations indicated that either open pan evaporation or net radiation could be used to estimate moisture use of forage crops under conditions where moisture was not limiting, provided a relationship had been established for the given species. To estimate moisture use on a daily basis, the appropriate ET/E or ET/Rn ratio was multiplied by the measured daily pan evaporation or the evapotranspiration equivalent of net radiation.

SWCRD, ARS, USDA, Thorsby, Ala., 35171

61. Miller, D. E. ESTIMATING MOISTURE RETAINED BY LAYERED SOILS. J. Soil and Water Conserv. 19(6): 235-237. 1964.

Estimates of the moisture retention characteristics of soils underlain by coarse layers were made. They were based on the unsaturated conductivity characteristics of the coarse material and the desorption characteristics of the overlying soil.

Satisfactory estimates were made when the soil was underlain by coarse materials containing few soil-size particles and when the interface was sharp (synthetic profiles and Ephrate soil). Less satisfactory but usable estimates were made when the underlying material was coarse to fine sand and the interface was not sharp (Rupert and Timmerman soils). When the underlayer contained appreciable soil-size material (Scooteney soil), reliable estimates were not made with the procedures outlined.

SWCRD, ARS, USDA, Prosser, Wash., 99350

62. Reginato, R. J., and Van Bavel, C. H. M. SOIL WATER MEASUREMENT WITH GAMMA ATTENUATION. Soil Sci. Soc. Amer. Proc. 28(6): 721-724. 1964.

Gamma-ray attenuation measurements of wet density were made with a 5-mc. Cs-137 source over a pathlength of about 30 cm. Data were obtained for glass-and-water systems as well as for soil materials of varying water content. The equipment was designed for use in the measurement of water content of soil in situ in 1-cm. increments, without any collimation of the beam.

Experimental results varified theoretical considerations on the use of gamma attenuation for soil water measurement. For equipment calibration, the unattenuated beam intensity and the attenuation coefficients for over-dry soil and water need be determined to make use of the exponential inverse square law for calculating the water content, given the dry density. The data demonstrated that the difference in the attenuation coefficients of dry soil and water must be taken into account.

Accuracy of the method, for a total count of 20,000 was 0.010 g. cm.-3 for water contents from 0.050 to 0.400 g. cm.-3 at a dry density of 1.300 g. cm.-3. For the same total count, a precision of 0.006 g. cm.-3 was demonstrated.

SWCRD, ARS, USDA, Tempe, Ariz., 85281

63. Haskell, C. C., and Hawkins, R. H. D_2O-NA^{24} METHOD FOR TRACING SOIL MOISTURE MOVEMENT IN THE FIELD. Soil Sci. Soc. Amer. Proc. 28(6): 725-728. 1964.

A unique method was described for measuring unsaturated flow of water in the field with D_2O tracer, a Na-24 gamma source, and a slow-neutron detector. The interaction of gamma radiation of energy greater than 2.23 Mev. and deuterium produces photoneutrons. The Na-24 gamma source and the slow-neutron detector are contained in a modified neutron-type soil moisture probe. The method successfully measured vertical movement of deuterium tracer in a Gilead sandy loam with the aid of access tubes.

Savannah River Plant, E. I. duPont de Nemours & Co., Aiken, S.C., 29801

64. Kashayap, M. M., and Ghildyal, B. P. FABRICATION OF ELECTRICAL RESISTANCE GYPSUM BLOCKS FOR FIELD MOISTURE DETERMINATION. J. Indian Soc. Soil Sci. 12(3): 145-150. 1964.

A method for casting of electrical resistance gypsum blocks was described. Three types of molds and various consistencies of plaster of paris mix were tried. A mold with provision for keeping the electrodes in correct position prior to casting and a mix of ratio 2:1 by weight of plaster of paris to distilled water gave the best results.

Indian Inst. Tech., Kharagpur, West Bengal, India.

65. Gupta, R. P., and Staple, W. J. INFILTRATION INTO VERTICAL COLUMNS OF SOIL UNDER A SMALL POSITIVE HEAD. Soil Sci. Soc. Amer. Proc. 28(6): 729-732. 1964.

Experimentally measured soil moisture profiles during infiltration into vertical columns of air-dry Grenville silt loam, under a small positive hydrostatic pressure, were compared with those predicted by the iterative procedure of Philip, and by an explicit finite difference method.

Philip's solution predicted the shape of the drier portion of the moisture profile satisfactorily, but the predicted depth of the zone of zero soil moisture tension and the total depth of infiltration were less than that found experimentally. Satisfactory estimates of the shape and depth of the moisture profile were provided by the second method when the high conductivities in the saturated and transition zones near the surface were taken into account.

Soil Res. Inst., Canada Dept. Agr., Ottawa, Ontario, Canada.

66. Ferguson, H., Brown, P. L., and Dickey, D. D. WATER MOVEMENT AND LOSS UNDER FROZEN SOIL CONDITIONS. Soil Sci. Soc. Amer. Proc. 28(5): 700-703. 1964.

Soil water and temperature distributions in a silty clay loam soil were studied in the field under freezing winter conditions. Appreciable upward water movement to a soil water was held at tensions of less than about 2 atm. and water held at tensions of less than 5 atm. moved toward the frozen zone contributed to overwinter water losses since soil water losses of 0.36 and 0.50 in. were measured from those plots in which there was appreciable upward water movement. Plots containing 7.9, 6.2, 4.2, and 1.4 in. of available water before freezing occurred conserved -.036, -0.50, 0.0, and 0.81 in., respectively, of the 4 inches of precipitation that occurred during the winter.

Mont. State Col., Bozeman, Mont., 59715

67. Dreibelbis, F. R., and Amerman, C. R. LAND USE, SOIL TYPE, AND PRACTICE EFFECTS ON THE WATER BUDGET. J. Geophys. Res. 69(16): 3387-3393. 1964.

Analyses of data from lysimeters and small watersheds near Coshocton, Ohio, indicated the effects of various soil and agronomic factors on the magnitude of the several elements of the water budget. From lysimeter data, the effects of soil types and agronomic practices upon the magnitude of evapotranspiration (ET) were shown for corn, wheat, and meadow in a 4-year rotation. From small-watershed data, the magnitudes of ET from various parts of the profile of Muskingum soils with covers of corn, pasture, and woods were indicated. Data from a 5-year period showed that, on similar soils, areas with a cover of shallow-rooted poverty grass had greater percolation and runoff, and lesser ET and water-use efficiency, than areas with a cover of deep-rooted birdsfoot trefoil.

Jr. Author, SWCRD, ARS, USDA, Coshocton, Ohio, 43812

68. Nielsen, D. R., Davidson, J. M., Biggar, J. W., and Miller, R. J. WATER MOVEMENT THROUGH PANOCHE CLAY LOAM SOIL. Hilgardia 35(17): 491-506. 1964.

Water movement through Panoche clay loam was explained on the basis of soil water properties within the profile. Laboratory-determined soil water content-tension relations from 3-inch cores taken from the field every 6 inches to 5 feet provided reliable estimates of soil water behavior. Water management practices relative to favorable plant-available soil water and favorable salt balance within the profile were discussed.

Tables and charts.

Agr. Pub., University Hall, U. Calif., Berkeley, Calif., 94720

69. Grover, B. L., Cahoon, G. A., and Hotchkiss, C. W. MOISTURE RELATIONS OF SOIL INCLUSIONS OF A TEXTURE DIFFERENT FROM THE SURROUNDING SOIL. Soil Sci. Soc. Amer. Proc. 28(5): 692-695. 1964.

The rates of wetting and drying of soil inclusions showed that the rate of rise of soil suction in the inclusion when compared with the surrounding soil was greatest with Ducor clay. The other soils followed in order of decreasing clay content. The rate of wetting was also greatest in the Ducor clay inclusion; the others were in the following order Coachella loamy sand>Ramona loam>Chino loam. The inclusions consisted of the soil ball on commercial nursery-grown citrus trees. The ball was wrapped in burlap in the usual manner. The chino loam inclusions took three times as long to wet as did the surrounding soil when they were placed in either the clay or the sand.

Extra caution must be used in orchard operation when the texture of the nursery soil is different from the field soil.

U. Calif., Citrus Res. Sta., Riverside, Calif., 92502

70. Wolf, D. D. SOIL MOISTURE EXTRACTION TRENDS OF SEVERAL LEGUME-GRASS MIXTURES AS AFFECTED BY CUTTING FREQUENCY AND NITROGEN FERTILIZATION. Agron. J. 56(5): 467-469. 1964.

Trends of soil moisture extraction were followed under legume-grass mixtures with Bouyoucos plaster-of-paris blocks placed at several depths below the soil surface. The mixtures were cut either three or five times per season, and received either 400 pounds of elemental nitrogen per acre or no nitrogen. Differences in soil moisture extraction among treatments were not apparent during 1960 because of well-distributed and adequate rainfall, but differences were apparent in 1961. Soil moisture extracted under mixtures cut three times was less at the 12-inch soil depth, but greater at the 48-inch depth, than with five cuttings. Soil moisture extraction throughout the season under alfalfa-grass mixtures receiving nitrogen was greater at 12 inches, and was usually less at 48 inches, than under mixtures receiving no nitrogen fertilizer.

Mixtures containing alfalfa extracted less available soil moisture at 12 inches, but extracted more at 48 inches, than mixtures containing birdsfoot trefoil or ladino clover. In general, alfalfa-grass mixtures cut three times per season and receiving no nitrogen had the highest level of available moisture in the soil surface to initiate regrowth following each cutting, and had the lowest level of soil moisture at the 48-inch depth.

U. Conn., Col. Agr. Expt. Sta., Storrs, Conn., 06268

Plant Food Review 10(2): 1-16. 1964.

This issue of Plant Food Review was devoted to Water—Essential Resource. The following articles were given:

71. White, W. C. A PERSPECTIVE OF WATER. Natl. Plant Food Inst., Washington, D.C., 20006

72. Viets, F. G., Jr. FERTILIZERS AND EFFICIENT WATER USE. SWCRD, ARS, USDA, Fort Collins, Colo., 80522

73. Barber, S. A. WATER—ESSENTIAL TO NUTRIENT UPTAKE. Purdue U., Lafayette, Ind., 47907

74. Gardner, W. H. WATER MOVEMENT IN SOIL. Wash. State U., Pullman, Wash., 99163

75. Peters, D. B. USE OF WATER BY PLANTS. SWCRD, ARS, USDA, Urbana, Ill., 61803

76. Peele, T. C. AVAILABILITY OF SOIL MOISTURE FOR PLANT GROWTH. Clemson U., Clemson, S.C., 29631

77. Kijne, J. W., and Taylor, S. A. THE TEMPERATURE DEPENDENCE OF SOIL WATER VAPOR PRESSURE. Soil Sci. Soc. Amer. Proc. 28(5): 595-599. 1964.

The temperature dependence of soil water vapor pressure was studied with a psychrometric vapor pressure technique in the range of 0.96 to 1.00 relative vapor pressures and below 0.96 with gravimetric and calorimetric heat of immersion techniques. For Millville silt loam at constant water content, the relative vapor pressure decreased with increasing temperature. Both differential and integral entropy values were calculated. The difference between the partial molar entropy of pure free water vapor and the partial molar entropy of adsorbed water led to the conclusion that soil water molecules are arranged, on the average, less randomly than water vapor molecules. Comparison with the entropy of vaporization of pure water suggested a more random arrangement of molecules in soil water than in free liquid water.

Utah State U., Logan, Utah, 84321

Soil Chemistry and Mineralogy

See Also 39, 95, 97, 108, 109, 110, 112, 116, 119, 123, 124, 129, 130, 131, 132, 135, 136, 137, 140, 141, 150, 168, 169, 173, 175, 176, 194, 195, 199, 211, 212, 220, 225, 265, 299, 307, 371, 372.

78. Mehlich, A. INFLUENCE OF SORBED HYDROXYL AND SULFATE ON NEUTRALIZATION OF SOIL ACIDITY. Soil Sci. Soc. Amer. Proc. 28(4): 492-496. 1964.

Soils of varying clay mineral characteristics were treated with anion-exchange resin to obtain systems containing either sorbed OH^- or SO_4^{2-}. They were then equilibrated with $Ca(OH)_2$, and the neutralization of acidity consisting of permanent charge (Hp), variable charge (Hv), and anion-exchange (Han, principally SO_4^{2-} absorbed) evaluated. The order of neutralization was Hp (consisting principally of Al^{3+} except in the case of the muck) first, followed virtually simultaneously by Hv and Han. Sorbed SO_4^{2-} resulted in more strongly acidic systems. Hv was postulated to arise from covalently bonded H of aquo groups in the coordination sphere of hydrated Al (or possibly Fe^{3+} atoms). The source of Han was postulated to be acid radicals substituted for OH groups, likewise in the coordination sphere of Al and Fe^{3+} associated with clay surfaces or in hydrous oxide crystals. The magnitude of Han, the soil acidity due to sorbed acid radical anions, may be an appreciable part of the total acidity of Red-Yellow Podzolic and Reddish-Brown Lateritic soils.

Soil Res. Advisor, Scott Agr. Lab., Nairobi, Kenya.

79. Clark, J. S., and Hill, R. G. THE pH-PERCENT BASE SATURATION RELATIONSHIPS OF SOILS. Soil Sci. Soc. Amer. Proc. 28(4): 490-492. 1964.

The curves obtained by plotting pH-1/2p (Ca+Mg) against percent base saturation calculated from the ratio of exchangeable Ca+Mg to the sum of Ca+Mg+Al+H extracted from soils with 1.0 N KCl had the characteristic shapes of clay titration curves. The experimental values for some montmorillonitic soils showed close agreement with the theoretical curve calculated for Al-bentonite. The Podzolic and Glei soils fell along another curve with lime potential values higher than those for the montmorillonitic soils at the same percent base saturation, indicating that the exchange properties of the soils differed from those of bentonite. No close relation was observed when the cation-exchange capacity (CEC) obtained with 0.9 N $Ca(OAc)_2$+0.1 N $CaCl_2$ or with 1.0 N $CaCl_2$ was used to calculate percent base saturation.

Soil Res. Inst., Res. Br., Canada Dept. Agr., Ottawa, Ontario, Canada.

80. Mehlich, A. INFLUENCE OF SORBED HYDROXYL AND SULFATE ON LIMING EFFICIENCY, pH, AND CONDUCTIVITY. Soil Sci. Soc. Amer. Proc. 28(4): 496-499. 1964.

Soils having different values of permanent charge (CECp), variable charge (CECv), and anion-exchange capacity (AEC) were treated with hydroxyl, sulfate, and hydrogen saturated exchange resins. The AEC was then principally OH^- or SO_4^{2-} saturated while CECp was principally saturated with alumino-hydronium and CECv with covalently bound H. To these systems were added increments of $Ca(OH)_2$ and the release of SO_4^{2-}, Ca^{2+} sorption efficiency, pH, and conductivity was measured.

Soils containing sorbed SO_4^{2-} had lower Ca^{2+} sorption efficiency, higher lime requirements, lower pH's, and higher specific conductivities than those containing sorbed OH^-. These effects were the result of replacement of sorbed SO_4^{2-} by OH^- according to the reaction:

$$\text{Soil-}SO_4 + Ca(OH)_2 \rightarrow \text{Soil-}(OH)_2 + CaSO_4$$

Soil Res. Advisor, Scott Agr. Lab., Nairobi, Kenya.

81. Helling, C. S., Chesters, G., and Corey, R. B. CONTRIBUTION OF ORGANIC MATTER AND CLAY TO SOIL CATION-EXCHANGE CAPACITY AS AFFECTED BY THE pH OF THE SATURATING SOLUTION. Soil Sci. Soc. Amer. Proc. 28(4): 517-520. 1964.

The effect of pH of the buffered saturating solution on the cation-exchange capacity (CEC) of 60 Wisconsin soils was determined within the pH range 2.5 to 8.0. The relative contributions of clay and organic matter to total CEC were measured, using multiple regression analyses; the independent variables were clay and organic matter contents and the dependent variables, CEC at pH 2.5, 3.5, 5.0, 6.0, 7.0, and 8.0. The average CEC of the organic matter at each pH value was 36, 73, 127, 131, 163, and 213 me. per 100 g., respectively; while that of the clay was 38, 46, 54, 56, 60, and 64 me. per 100 g.

Within the limits of the standard errors of the regression coefficients, CEC of both clay and organic matter increased linearly with pH. The regression equations indicated that the mean relative contribution of organic matter to total soil CEC in this group of soils varied from 19 percent at pH 2.5 to 45 percent at pH 8.0; the mean organic matter and clay contents of the soils studied were 3.28 percent and 13.3 percent, respectively. Coefficients of multiple correlation varied from 0.927 at pH 3.5 to 0.959 at pH 8.0.

U. Wis., Madison, Wis., 53706

82. Martin, J. P., Richards, S. J., and Pratt, P. F. RELATIONSHIP OF EXCHANGEABLE Na PERCENTAGE AT DIFFERENT SOIL pH LEVELS TO HYDRAULIC CONDUCTIVITY. Soil Sci. Soc. Amer. Proc. 28(5): 620-622. 1964.

The relation of exchangeable Na percentage of different soil pH levels to the hydraulic conductivity of six soils with exchange capacities varying from 7.5 to 50.8 me. per 100 g. was studied. The same quantities of Na reduced hydraulic conductivity more in acid than in neutral or alkaline soils. This response was studied further by correlating hydraulic conductivity with Na percentage calculated relative to each of three quantities: (1) The cation-exchange capacity (CEC) at pH 7; (2) the CEC at the pH of the soil sample; and (3) the sum of exchangeable Ca, Mg, K, and Na. Highly significant correlation coefficients relating hydraulic conductivity to Na percentage were obtained for all six soils when Na was expressed as a percentage of Ca + Mg + K + Na. Calculation of the Na percentage on the basis of the CEC at the pH of the soil and at pH 7 gave highly significant correlation coefficients in four and two soils, respectively.

U. Calif. Citrus Res. Center., Riverside, Calif., 92502

83. Romkens, M. J. M., and Bruce, R. R. NITRATE DIFFUSIVITY IN RELATION TO MOISTURE CONTENT OF NON-ADSORBING POROUS MEDIA. Soil Sci. 98(5): 332-337. 1964.

The magnitude of the effective nitrate diffusivity and its dependency on the moisture content of non-adsorbing porous media _in casu_ sand, glass beads, and silt was investigated in a closed, infinite, one-dimensional system. At each measurement, packed columns, equilibrated at a specified moisture content with equimolar solutions of $NaNO_3$ and NaCl, respectively, were contacted. The diffusion process was allowed to proceed until the quantity of diffused substance was in the readily measurable range of the modified phenol-disulfonic acid method. The effective nitrate diffusivity was calculated according to an integrated form of the diffusion equation applicable to this system.

The ratio of the effective nitrate diffusivity to the diffusivity of nitrate in bulk solution, determined by a diaphragm-cell procedure, yielded a transmission factor $\propto$. The relationship of $\propto$ to the moisture content was shown to have an exponential character in the media employed, as evidenced by the highly significant correlation coefficients. The relationship obtained indicates that the ion-diffusion process is more seriously affected by a reduction in moisture content at high than at low moisture levels.

Jr. Author, Miss. State U., Miss. Agr. Expt. Sta., State College, Miss., 39762

84. Clark, J. S. ALUMINUM AND IRON FIXATION IN RELATION TO EXCHANGEABLE HYDROGEN IN SOILS. Soil Sci. 98(5): 302-306. 1964.

Cation-exchange capacities (CEC) were reduced when soil clays and a carboxyl cation-exchange resin were saturated with Al or Fe and titrated to pH 5.5, or when excess $Al(OH)_3$ or $Fe(OH)_3$ was precipitated in the presence of the clay at pH 5.5. Hydrogen was released from the Al- and Fe-treated clays, and resins and the cation-exchange capacities increased by repeated extraction with KOAc at pH 7.

The Al-treated clays had low CEC values, measured by exchange saturation with $CaCl_2$, but high values when $Ca(OAc)_2+CaCl_2$ at pH 7 was used, so that the samples had a large pH-dependent component of the CEC.

The reduction of the cation-exchange capacities was attributed to the interaction of aluminum or iron hydroxy polymers (OH/Al or OH/Fe ratio less than 3) with the exchange materials. The exchange sites were released and exchangeable hydrogen apparently liberated by conversion of the "fixed" aluminum and iron to $Al(OH)_3$ or $Fe(OH)_3$.

Canada Dept. Agr., Ottawa, Ontario, Canada.

85. James, D. W., and Harward, M. E. COMPETITION OF NH_3 AND H_2O FOR ADSORPTION SITE ON CLAY MINERALS. Soil Sci. Soc. Amer. Proc. 28(5): 636-640. 1964.

Ammoniation of air-dry Ca, Mg, and Al montmorillonite and bentonite resulted in dehydration of the exchangeable cations and a change in c-axis spacing from 15 to 16Å. to 12.6 to 13Å. Ammoniation of a vacuum-dried Ca system resulted in a change in c-axis spacing from 10.1 to 12.3Å. On the other hand, NH_3 retained by the minerals upon ammoniation was replaced by H_2O under controlled conditions of relative humidity.

It was postulated that the mutual competition between H_2O and NH_3 molecules for adsorption sites could be described by the law of mass action. The various theories that have been proposed to describe the mechanism of NH_3 chemisorption were discussed.

Wash. State U. Irrig., Expt. Sta., Prosser, Wash., 99350

86. Rich, C. I. EFFECT OF CATION SIZE AND pH ON POTASSIUM EXCHANGE IN NASON SOIL. Soil Sci. 98(2): 100-106. 1964.

A study was made of K^+ exchange in a Nason subsoil that released K^+ to NH_4OAc an $MgCl_2$ but not to $Mg(OAc)_2$. The extent of K^+ exchange was determined largely by the diameter of the exchanging solvated cation and by the pH of the system. Potassium exchange by monovalent or divalent cations increased from 0.00 to 0.36 me. per 100 g. with decreasing effective cation size.

The release of exchangeable K^+ by $MgCl_2$ probably was due largely to the indirect effect of increasing the H^+ ion concentration. Exchange of K^+ by H_3O^+ ions, produced by the reaction of the nonbuffered $MgCl_2$ with the acid soil, probably accounted for most of the K^+ exchange.

Wedge-shaped interlayer spaces in interstratified vermiculite-mica were proposed as the "selective sites" for K-size ions. Large hydrated ions such as Ca^{++} and Mg^{++} were excluded from such sites.

Va. Polytech. Inst., Blacksburg, Va., 24061

87. Weber, J. B., and Caldwell, A. C. SOIL AND PLANT POTASSIUM AS AFFECTED BY SOIL TEMPERATURE UNDER CONTROLLED ENVIRONMENT. Soil Sci. Soc. Amer. Proc. 28(5): 661-667. 1964.

Studies on the effect of soil temperature and moisture on the K-supplying power of two soils were carried out in a growth chamber. Air temperature and lighting were programmed to follow a constant daily cycle, while soil temperature was kept constant with an insulated water bath assembly. Soil and plant K determinations were made at each of five stages of growth. Regression and correlation analyses were performed to describe the various response curves. Correlations were also made to describe the relationships between the plant and soil K measurements.

Soil temperature had a tremendous effect on the K-supplying power of the Floyd soil and much less of an effect on the Milaca soil. Plant yields were increased similarly on both soils with increased soil temperature, but K yields on the Floyd soil were increased from two to three times those of the Milaca soil. A significant response to applied K was obtained on both soils at low soil temperatures, but only the Milaca soil showed a substantial response at the high soil temperature.

Correlations between plant and soil K measurements indicated that plants on the Milaca soil utilized exchangeable K at both low and high soil temperatures, whereas those on the Floyd soil utilized exchangeable K at low soil temperatures, and both exchangeable and nonexchangeable forms at high soil temperatures. Both soils fixed substantial amounts of applied K, but temperature effects on the two soils were very different and it appeared as though different fixation processes were involved. Yield increases from K applications were obtained on Floyd soil at low temperatures but not at high temperatures.

Agr. Expt. Sta., N.C. State, Raleigh, N.C., 27607

88. Chao, T. T., Harward, M. E., and Fang, S. C. IRON OR ALUMINUM COATINGS IN RELATION TO SULFATE ADSORPTION CHARACTERISTICS OF SOILS. Soil Sci. Soc. Amer. Proc. 28(5): 632-635. 1964.

Studies were conducted to investigate the effects of hydrous Fe- and Al-oxides in relation to pH upon SO_4 retention by soils. "Less SO_4- retentive " soils exhibited SO_4 adsorption of the Latosols or Ando soils after coating with the hydrous oxides. The pH-dependent SO_4 retention was much more marked after the coatings were applied. Retentive soils were made much less retentive by treatments for the removal of the hydrous oxides while the less retentive soils showed appreciable SO_4 adsorption when the hydrous oxides were added. In the acid range, the amount of SO_4 adsorption was essentially proportional to the amounts of hydrous Fe- or Al-oxides present. Aluminum-oxides were more effective in retaining SO_4 than were the Fe-oxides when both were present as coatings on soil particles. The Fe system exhibited increasing adsorption with increased acidity, whereas the Al system showed a maximum at pH 4.0. Subsequent decreases of SO_4 adsorption by Al-coated soils at lower pH values were shown to be associated with dissolution of the hydrous Al oxide phase.

Pineapple Res. Inst., Honolulu, Hawaii, 96814

89. Cate, R. B., Jr., and Sukhai, A. P. A STUDY OF ALUMINUM IN RICE SOILS. Soil Sci. 98(2): 85-93. 1964.

In a study of the effect of aluminum in rice soils, the authors concluded that:

1. In the absence of nutrient cations, water-soluble aluminum concentrations as low as 1 to 2 p.p.m. markedly inhibited the growth of rice roots. Higher concentrations prevented root growth altogether and produced a characteristic brown mottling of the leaves, especially at the tips and along the edges, which resulted eventually in necrosis. These leaf symptoms occurred within 3 weeks at aluminum concentrations as low as 25 p.p.m. Calcium, magnesium, and nitrate could alleviate but not eliminate this sensitivity to aluminum.
2. When soluble neutral salts were less than about 1800 p.p.m., water-soluble aluminum ions could be expected only if more than about 60 percent of the salt-displaceable cations consisted of aluminum.
3. Under the reducing conditions typical of rice paddies, exchangeable aluminum was replaced by exchangeable ferrous iron. When the soil became reoxidized, the aluminum reappeared in the exchangeable form. In addition, some non-displaceable acidity appeared to be neutralized, and in "cat clays" the reduction of sulfates to sulfides could be a contributing factor.

4. If the ferrous neutralization reaction was properly taken advantage of, by early and continuous flooding, and if excess salt was removed by leaching, the principal problem for rice culture on aluminum-rice soils was fertility.
5. Where feasible, leaching with sea water could materially assist in improving exchangeable aluminum through displacement and by improvement of the nutrient status.

Soil Chemist, FAO, United Nations Spec. Fund Soil Survey Project, British Guiana.

90. Brown, A. L., and Jurinak, J. J. EFFECT OF LIMING ON THE AVAILABILITY OF ZINC AND COPPER. Soil Sci. 98(3): 170-173. 1964.

The availability of zinc and copper as affected by lime was studied in the greenhouse, using rates up to 50 percent $CaCO_3$ on two soil types.

There was practically no growth depression due to lime treatment in the Yolo fine sandy loam, but there was a significant deperession in the Yolo clay with increasing lime rates.

The concentrations of Zn and Cu in the plant tissue were not markedly affected by increasing lime rates, particularly when the pH was not altered.

Dithizone-extractable Zn in the soil decreased somewhat as a result of liming but at most of the lime rates, the supply appeared to be adequate.

U. Calif., Davis, Calif., 95616

91. Lewis, G. C., and White, J. L. CHEMICAL AND MINERALOGICAL STUDIES ON SLICK SPOT SOILS IN IDAHO. Soil Sci. Soc. Amer. Proc. 28(6): 805-808. 1964.

A study of a slick spot and associated soils showed the slick spot soil to be characterized by high salts and exchangeable Na throughout the profile. The high concentration of salts and exchangeable Na occurred at progressively greater depths in the profile in proceeding from the slick spot into the adjacent associated soils.

The clay-size minerals found in both the slick spot soils and the associated soils were illite, montmorillonite, kaolinite, quartz, and feldspars. Montmorillonite maxima occurred at progressively lower depths in the profile in proceeding from the slick spot into the associated soils.

Partial dissolution studies on the clay-size fraction of the soils showed large amounts of amorphous material with the greatest amount being present in the slick spot soil. It was postulated that this amorphous material, together with the high Na content, contributed to the impermeability of these soils.

U. Idaho, Idaho Agr. Expt. Sta., Moscow, Idaho, 83843

92. Keeney, D. R., and Bremner, J. M. EFFECT OF CULTIVATION ON THE NITROGEN DISTRIBUTION IN SOILS. Soil Sci. Soc. Amer. Proc. 28(5): 653-656. 1964.

The effect of cultivation on the nitrogen distribution in soils was studied by determining total N, nonexchangeable ammonium N, nonhydrolyzable N, and hydrolyzable (total, ammonium, hexosamine, amino acid, unidentified) N in 10 virgin soils and their cultivated analogues.

Cultivation led to a marked decrease in all forms of N except nonexchangeable ammonium N, but, on the average, had little effect on the percentage distriubtion of N. The average percent loss of total N on cultivation was 36.2 percent, and the average losses of different forms of N, calculated as percentages of loss in total N, decreased in the order: hydrolyzable N(70.5 percent)>amino acid N (29.8 percent)>nonhydrolyzable N (29.5 percent)>unidentified hydrolyzable N (20.0 percent)>hydrolyzable ammonium N (17.1 percent)>hyxosamine N (3.5 percent)>nonexchangeable ammonium N (0.5 percent).

On the average, cultivation led to small increases in the proportions of total N as nonexchangeable ammonium N, hydrolyzable N, hexosamine N, and hydrolyzable ammonium N; and to small decreases in the proportions as nonhydrolyzable N, amino acid N, and unidentified hydrolyzable N. The average percent losses of different forms of N on cultivation decreased in the order: amino acid N (43.0 percent)>nonhydrolyzable N (39.4 percent)>total N (36.2 percent)>total hydrolyzable N (35.2 percent)>unidentified hydrolyzable N (34.5 percent)>hydrolyzable ammonium N (28.6 percent)>hexosamine N (27.6 percent)>nonexchangeable ammonium N (0.2 percent).

Iowa Agr. and Expt. Sta., Ames, Iowa, 50010

93. Patrick, W. H., and Wyatt, R. SOIL NITROGEN LOSS AS A RESULT OF ALTERNATE SUBMERGENCE AND DRYING. Soil Sci. Soc. Amer. Proc. 28(5): 647-653. 1964.

Successive cycles of submergence and drying resulted in the loss of 15 to 20 percent of the total soil nitrogen. Nitrogen was nitrified during the aerated portion of the cycle and lost when the soil was submerged. Most of the loss occurred during the first three cycles of submergence and drying. The soil oxidation-reduction potential decreased rapidly after the initial submergence. The more times the soil had been submerged and dried, the slower the oxidation-reduction potential decreased when the soil was again submerged. Carbon and nitrogen were lost in approximately the same ratio that they occurred in the soil.

La. State U., University Station, La., 70803

94. Gambell, A. W., and Fisher, D. W. OCCURRENCE OF SULFATE AND NITRATE IN RAINFALL. J. Geophys. Res. 69(20): 4203-4210. 1964.

A study was made of the mineral composition of individual rainfalls at Prince William National Forest Park, Va. Data were presented showing variations in the composition of rainfall during the course of six separate storms. The data supported the theory that much of the SO_4^{--}, NO_3^-, and NA_4^+ in rainfall are derived primarily from gaseous constituents of the atmosphere. The origin of NO_3^- in thunderstorm rainfall was discussed, and evidence was given to show that the role of lightning was almost certainly unimportant.

U.S. Geol. Survey, Dept. Int., Washington, D.C., 20240

Soil Biology

See Also 92, 93, 101, 119, 169, 231, 299.

95. Aitken, J. B., Acock, B., and Senn, T. L. THE CHARACTERISTICS AND EFFECTS OF HUMIC ACIDS DERIVED FROM LEONARDITE. S.C. Agr. Expt. Sta. Tech. B. 1015, 28 pp. 1964,

A summary of 3 years of laboratory, field, and greenhouse work with humic acids was given to bring together all of the various phases of the work and to show their relationship one to another.

Detailed procedures for the solvent and chromatographic separation of the humic acids were presented. Various physical and chemical properties of the humic acids were described, and these were related to their effects on plant growth in field and greenhouse experiments. The effects of humic acids on root and leaf respiration were also discussed.

S.C. Agr. Expt. Sta., Clemson U., Clemson, S.C., 29631

96. Miller, R. C., and Johnson, D. D. THE EFFECT OF SOIL MOISTURE TENSION ON CARBON DIOXIDE EVOLUTION, NITRIFICATION, AND NITROGEN MINERALIZATION. Soil Sci. Soc. Amer. Proc. 28(5): 644-647. 1964.

Four soils were incubated at 30° C. for 14 days under soil moisture conditions varying from zero tension to air-dry soil after which No_3-N and NH_4-N were measured. Carbon dioxide evolved from the soils was collected continuously and measured at the end of 1, 2, 3, 7, and 14 days. Carbon dioxide production during the first day increased from a minimum in air-dry soil to a maximum at tensions of from 0.50 to 0.15 bars, and then decreased with further increase in soil moisture. At the end of the incubation period there was little difference in the CO_2 evolved in the tension range from zero to 0.15 bar.

Maximum nitrification occurred in the tension range of 0.50 to 0.15 bars. There was a peak in both N mineralized and N nitrified in this tension range followed by a decline in NH_4-N and NO_3-N to about zero tension, where there was another peak in N mineralization. Nitrification proceeded at tensions about 15 bars tension but at a very slow rate. Ammonification took place at a faster rate at both high and low tensions, indicating that NH_4-N can accumulate in soil at high tensions (up to air-dry) and low tensions (near zero bars).

Colo. Agr. Expt. Sta., Colo. State U., Fort Collins, Colo., 80521

97. Smith, J. H. RELATIONSHIPS BETWEEN SOIL CATION-EXCHANGE CAPACITY AND THE TOXICITY OF AMMONIA TO THE NITRIFICATION PROCESS. Soil Sci. Soc. Amer. Proc. 28(5): 640-644. 1964.

Nitrification was studied in Red Bay sandy loam and Iredell clay loam treated with increments of sand to produce a range of cation-exchange capacities (CEC). The soils were treated with 1 percent additions of alfalfa particles of three particle sizes. Analyses were made at intervals for ammonia, nitrate, nitrite, and pH.

The nitrification rate of ammonia from alfalfa particles decomposing in soil was decreased when the exchange capacity of the soil was decreased by dilution with sand. The mechanism involved less exchange sites for NH_4^+ at low CEC and the resulting increase in soil solution pH producing an NH_3 concentration that was toxic to Nitrobacter. The same effect was produced by decreasing the distance between the alfalfa particles in the soil, thereby reducing the interparticle zones of low NH_3 concentration where nitrification could proceed.

A steep ammonia concentration gradient developed around the alfalfa particles when adequate exchangeable hydrogen was present. In the areas between alfalfa particles, where NH_3 concentration was low, nitrification proceeded without inhibition. As the exchangeable hydrogen concentration was reduced or the alfalfa particles were placed closer together, the zones were NH_3 was not toxic decreased in size until most of the soil had reached the concentration of NH_3 toxic to nitrification.

U.S. Soils Lab., SWCRD, ARS, USDA, Beltsville, Md., 20705

See Also 20, 39, 70, 89, 90, 97, 170, 173, 174, 178, 194, 195, 196, 197, 198, 205, 206, 211, 212, 213, 230, 234, 240, 247, 293, 301, 308, 319, 347, 349, 351, 352, 353, 355, 356, 357, 358.

98. Kender, W. J., and Anastasia, F. NUTRIENT DEFICIENCY SYMPTOMS OF THE LOWBUSH BLUEBERRY. Proc. Amer. Soc. Hort. Sci. 85: 275-280. 1964.

Two-year-old rooted cuttings of a single clone of the lowbush blueberry (Vaccinium angustifolium Ait.) were grown in sand cultures with nutrient solutions each lacking one of nine essential elements. Deficiency symptoms of -N and -K were produced first, followed by Fe, Mg, B, Ca, Mn, and P. No symptoms of Zn deficiency appeared during the experiment.

Symptoms of Ca deficiency were in accordance with those previously described for the lowbush blueberry. N, P, K, Mg, and Fe deficiency symptoms, however, were dissimilar. Mn deficiency was reported for the first time for blueberries. Symptoms of the various deficiencies were described.

U. Maine, Orono, Maine, 04473

99. Wallihan, E. F., Embleton, T. W., and Sharpless, R. G. RESPONSE OF CHLOROTIC CITRUS LEAVES TO IRON SPRAYS IN RELATION TO SURFACTANTS AND STOMATAL APERTURES. Proc. Amer. Soc. Hort. Sci. 85: 210-217. 1964.

Possible advantages of a high concentration (0.5 percent) of an efficient surfactant, incorporated in Fe-spray solutions for correcting Fe deficiency chlorosis of citrus, were investigated.

Greenhouse tests on orange seedlings, rated visually, showed that the surfactant Vatsol OT at 0.5 percent by weight gave better results than at 0.25 percent, if applied during the day when stomates were open. The same treatments applied at night, when stomates were closed, brought no response.

In a field experiment on mature Fe chlorotic lemon trees, a portable reflectometer was used to measure chlorophyll concentrations in leaves before and after spray application of Fe solutions. Response increased as concentration of surfactant was increased from 0.1 percent to 0.5 percent. Treatment after sunrise was superior to treatment before sunrise. Four Fe compounds (ferrous sulfate and three commercial organic complexes) caused substantial, significant, and similar increases in chlorophyll concentrations in leaves when applied at 1,000 p.p.m. Fe and 0.5 percent Vatsol OT in the spray solution. A moderate degree of injury to leaves and fruit was observed in some instances, partly due to the surfactant alone.

U. Calif., Citrus, Res. Cent. and Agr. Expt. Sta., Riverside, Calif., 92502

100. Bingham, F. T., Page, A. L., and Bradford, G. R. TOLERANCE OF PLANTS TO LITHIUM. Soil Sci. 98(1): 4-8. 1964.

Lithium tolerance of 11 plant species was noted by growing plants in soil treated with Li_2SO_4 in amounts ranging up to that producing visible injury. Plants known to be readily injured by low substrate levels of Na were likewise readily injured by low additions of Li. Avocados, sour oranges, and beans were the plants least tolerant of Li_2SO_4. The grasses, cotton beets, and corn were relatively tolerant of high Li additions.

Sand culture experiments were conducted with beans, tomatoes, and sour orange seedlings to establish toxic Li concentrations in the substrate. Solution concentrations of 5 p.p.m. Li were generally not toxic. It was concluded that irrigation water analysis (≈0.05 to 0.50 p.p.m. Li) would not directly suggest a toxicity.

U. Calif. Citrus Res. Cent. and Agr. Expt. Sta., Riverside, Calif., 92502

101. Runox, Y. V., and Yegorova, S. V. TOXICOSIS OF DARK GRAY FOREST SOILS UNDER OAK STANDS IN THE FOREST-STEPPE ZONE. Soviet Soil Sci. 12: 1171-1177. Dec. 1963.

The toxicosis of dark gray forest soils was studied in oak stands of the Borisoglev forest area in Voronezh Oblast'. The authors concluded that:

1. Dark-gray forest soils under oak are toxic to several microorganisms and plants, including oak. Cultivated soils and those under meadow vegetation are less toxic than forest soils.
2. The toxicity of soils under oak increases with age of the stand. The most toxic soils were those in the 220-year-oak stand.
3. The toxicity of soils in old oak stands may stunt the growth of oak seedlings and thus, along with other factors, hamper natural regeneration of the forest.
4. The toxicity of soils in oak forests is caused by the entry of phytocidal substances from roots and aerial parts of oak trees into the soil. If there is a small amount of moisture, these substances accumulate, but in wet soil they are decomposed.
5. Microorganisms, chiefly nonspore-forming bacteria, which are capable of decomposing toxic substances, play an important role in the process. Cultivation of the soil, aeration, and other factors that stimulate the microflora help to decompose these substances.

Scripta Technica, Inc., 1000 Vermont Ave., N.W., Wash., D.C., 20005

Wyoming Agricultural Experiment Station. METABOLIC EFFECTS AND METABOLISM OF Se IN ANIMALS. Wyo. Agr. Expt. Sta. B. 414, 64 pp. 1964.

The studies presented in the following papers were part of a long-term program dealing with various phases of selenium metabolism and the metabolic interferences produced by selenium in animals:

102. Rosenfeld, I. EFFECT OF CHRONIC SELENOSIS ON P^{32} METABOLISM IN THE LIVER.

103. Rosenfeld, I. DISTRIBUTION OF P^{31} AND P^{32} IN TISSUES OF NORMAL ANIMALS AND IN ANIMALS WITH CHRONIC SELENOSIS.

104. Rosenfeld, I. EFFECT OF COPPER, ZINC, AND URANIUM ON CHRONIC SELENOSIS.

105. Rosenfeld, I. EXCRETION AND RETENTION OF Se^{75} IN RELATION TO MODES OF ADMINISTRATION, TOXICITY, AND PREGNANCY IN RATS.

106. Rosenfeld, I., and Eppson, H. F. METABOLISM OF SELENIUM IN SHEEP.

U. Wyo., Agr. Expt. Sta., Laramie, Wyo., 82071

107. Jones, M. B., and Martin, W. E. SULFATE-SULFUR CONCENTRATION AS AN INDICATOR OF SULFUR STATUS IN VARIOUS CALIFORNIA DRYLAND PASTURE SPECIES. Soil Sci. Soc. Amer. Proc. 28(4): 539-541. 1964.

Plant samples were taken from annual-type pastures that had been fertilized with varying rates of S. When additional N was applied at 160 lb./A., SO_4-S concentrations were the same in both soft chess and subclover. When no N was applied, grasses had higher concentrations of SO_4-S than did legumes. Hardinggrass was particularly higher in SO_4-S than was rose or subclover.

In subclover, SO_4-S concentrations were determined at the early vegetative stage (February), at flowering (May), and when wilting and drying had begun (June). The SO_4-S decreased until flowering, and then increased at the wilting stage.

It was concluded that rose clover and subclover were the best plants on which to determine SO_4-S concentrations for evaluating the S status of a pasture. Clover samples taken during the flowering period but before wilting gave the best indication of S status. The SO_4-S values in grasses apparently were dependent upon N levels in the soil as well as upon S levels. However, under high N fertility programs, SO_4-S levels in grasses also could be used to indicate S status. More detailed work is needed before SO_4-S in native clovers can be used.

U. Calif., Hopland Field Sta., Hopland, Calif., 95449

108. Voight, G. K., Richards, B. N., and Mannion, E. C. NUTRIENT UTILIZATION BY YOUNG PITCH PINE. Soil Sci. Soc. Amer. Proc. 28(5): 707-709. 1964.

Ten pitch pines (Pinus rigida Mill.) ranging in age from 5 to 9 years were excavated from an abandoned gravel pit in southern New Jersey. Lateral and vertical distribution of the root systems was recorded, and total soil volume occupied by roots was calculated (root system sorption zone). In addition, the volume of soil within 1 cm. of any root surface was calculated (root surface sorption zone). Contents of total and exchangeable Ca and K in these zones were related to contents of Ca and K in the trees.

Exchangeable Ca and K contents in the root system sorption zone were generally higher than the total content of these nutrients in the trees while the reverse was true for the relationship between the root surface sorption zone and the tree. Annual uptake of K by the trees was approximately equal to exchangeable K content of the root surface sorption zone. Annual uptake of Ca by trees was only about one-third of the exchangeable Ca in the root surface sorption zone, indicating that average distance of movement of Ca from soil to root surface was less than that for K. Less than 10 percent of the total soil volume occupied by roots was utilized in adsorption of Ca and K.

Yale School Forestry, New Haven, Conn., 06520

109. Abruna, F., Vicente-Chandler, J., and Pearson, R. W. SOIL FERTILITY AND PLANT NUTRITION. Soil Sci. Soc. Amer. Proc. 28(5): 657-661. 1964.

Heavily fertilized tropical grasses responded strongly to liming on two typical soils of the Humid Tropics. Liming increased the Ca and decreased the Mn content but did not affect the phosphorus or Mg content of the grasses. Surface applications of limestone were as effective as mixing limestone with the surface soil and one application was as effective as two applications at 2-year intervals.

Exchangeable Al and Mn content of the soils was sharply increased by fertilization alone, but was decreased by liming. Base content at all depths sampled was decreased by fertilization alone, but was increased by surface liming followed by heavy fertilization. Yields of grasses increased markedly with pH of the upper 6 inches to about 4.8, with bases to 8.0 me. per 100 g. of soil and with decreasing exchangeable Al to 2 me. per 100 g. of soil.

Heavy fertilization of grasses over a 4-year period without liming greatly depressed yields of subsequently planted tobacco, and this effect was only partly compensated by reliming prior to planting the tobacco.

SWCRD, ARS, USDA, Rio Piedras, Puerto Rico, 00928

110. Nichol, W. E., and Mack, A. R. ELEMENTAL COMPOSITION OF APPLES IN RELATION TO FRUIT QUALITY, SOIL ACIDITY AND ORGANIC MATTER. Proc. Amer. Soc. Hort. Sci. 85: 91-99. 1964.

Quality of McIntosh apples from three orchards in the Ottawa, Ontario area was found to be differentially related to the concentration of various elements in the flesh. Mn was positively correlated with quality, whereas Fe and particularly Cu were negatively correlated. Inclusion of Zn, Ca + Mg, P, and K did not consistently improve the correlation coefficients.

Mn concentration in the fruit flesh was better related to the combined pH of the three soil layers between 0 and 24+ inches than to any single layer, and was not related to the total organic matter content. Cu and Fe in the flesh were associated with the organic matter content of the surface soil layer and with the pH of the subsurface soils.

Res. Br. Canada Dept. Agr., Ottawa, Ontario, Canada.

111. Haddock, J. L., and Stuart, D. M. CRITICAL LEVELS VERSUS QUANTITY-QUALITY FACTORS FOR ASSESSING NUTRITIONAL STATUS OF SUGAR BEET PLANTS. J. Amer. Soc. Sugar Beet Tech. 13(1): 42-58. Oct. 1964.

The critical level procedure as proposed by Ulrich (1948) for diagnosing nutritional disturbances in the sugar beet has been demonstrated as a useful tool in commercial fields. In its present form and for nutrient culture studies, this technique appears to lack sensitivity. Pot culture studies revealed that concentrations of plant nutrients in plant tissue may be considerably above proposed critical levels, and yet not high enough to support maximum yield of roots and sugar.

A modification of the Thomas (1945) method appears to be well suited to the diagnosis of nutritional disturbances which adversely influence yield of sugar beet roots and sugar. Not only was the quantity-quality technique sensitive as a measure of minimum concentrations which limit plant performance, but it appeared to be suitable as a device for the recognition of luxury consumption of plant nutrients.

It appeared that the essential nutrient concentrations in plant tissue responsible for optimum production of plant material was relatively narrow. Additional study is needed to determine more precisely the influence of season and a wide range in nutrient availability on plant performance and composition.

SWCRD, ARS, USDA, Logan, Utah, 84321

112. Duell, R. W. FERTILIZER-SEED PLACEMENT WITH BIRDSFOOT TREFOIL (LOTUS CORNICULATUS L.) AND ALFALFA (MEDICAGO SATIVA). Agron. J. 56(5): 503-505. 1964.

Field experiments employing precision placement of seed (birdsfoot trefoil and alfalfa, separately) and fertilizers were conducted on loam soils of the Penn series that were low in fertility but made favorable in pH.

The general superiority of alfalfa over birdsfoot trefoil in germination, height, weight, field emergence, and ability to benefit from proximity to applied complete fertilizers was noteworthy. Alfalfa was higher in percent phosphorus and amounts taken up by the seedlings, but was lower than birdsfoot trefoil in percent potassium and weight of potassium taken up. Both legumes showed reduced emergence when their seeds were close to concentrations of soluble fertilizers while soil moisture was low.

Band seeding did not contribute to success in the establishment of birdsfoot trefoil to the degree that it did alfalfa.

Rutgers—The State U., New Brunswick, N.J., 08903

113. Ambler, J. E. TRANSLOCATION OF STRONTIUM FROM LEAVES OF BEAN AND CORN PLANTS. Radiation Bot. 4: 259-265. 1964.

Translocation of Sr-85 from leaves of bean and corn plants to plant parts was measured at successive stages of growth. Translocation was greater from leaf applications that were periodically rewetted than from applications allowed to air dry and stay dry. The maximum amounts of Sr-85 translocated from rewetted bean and corn leaves were about 0.6 and 0.5 percent, respectively, of that applied. In bean plants, the greatest translocation occurred from the youngest leaf (four trifoliate), treated 20 days after the straightening of the hypocotyl. In corn, this occurred from the youngest leaf (leaf nearest the tassel) treated 10 days before pollination. Translocation of Sr-85 into roots and fruit parts, from rewetted applications, was less than 0.0006 percent of that applied. From most foliar treatments, allowed to air-dry and stay dry, translocation was less than 0.01 percent of that applied.

U.S. Soils Lab., SWCRD, ARS, USDA, Beltsville, Md., 20705

114. Jyung, W. H., and Wittwer, S. H. FOLIAR ABSORPTION—AN ACTIVE UPTAKE PROCESS. Amer. J. Bot. 51(4): 437-444. 1964.

Mechanisms of foliar absorption of phosphate and rubidium in primary leaves of bean seedlings were resolved by a newly developed leaf-immersion and leaf-washing technique. Uptake was expressed as "specific absorption," defined as mμmoles/cm^2 leaf × 24 hr. from a known concentration of substance in an external solution maintained in a known environment. Criteria for active uptake included time course analysis, temperature, oxygen, and energy dependence, sensitivity to metabolic inhibitors, accumulation against a concentration gradient, irreversibility, and pH dependence.

The results suggest that the overall process of foliar absorption of rubidium and phosphate by bean leaves, beginning with zero time and extending over a 24-hr. period, is metabolic. It was proposed that carriers play an important role in uptake, and that they are proteinaceous.

Mich. State U., East Lansing, Mich., 48823

115. Page, A. L., and Martin, J. P. GROWTH AND CHEMICAL COMPOSITION OF CITRUS SEEDLINGS AS INFLUENCED BY Na ADDITIONS TO SOILS LOW IN EXCHANGEABLE K. Soil Sci. 98(4): 270-273. 1964.

The effects of Na additions to K-deficient soils on the growth and chemical composition of citrus seedlings were reported. Results indicated that Na will not substitute, to any measurable degree, for the metabolic functions of K in citrus seedlings, and would not increase the availability of K to citrus seedlings grown under K-deficient soil conditions. Levels of less than 0.8 percent exchangeable soil K and orange seedling leaf levels less than approximately 0.9 percent K were associated with decreased plant dry weights. Potassium-deficiency symptoms of sweet orange seedlings were associated with leaf K concentrations of 0.28 to 0.44 percent.

U. Calif. Citrus Res. Cent., Agr. Expt. Sta., Riverside, Calif., 92502

116. Jung, G. A., Lilly, B., Shih, S. C., and Reid, R. L. STUDIES WITH SUDANGRASS: I. EFFECT OF GROWTH STAGE AND LEVEL OF NITROGEN FERTILIZER UPON YIELD OF DRY MATTER; ESTIMATED DIGESTIBILITY OF ENERGY, DRY MATTER AND PROTEIN: AMINO ACID COMPOSITION; AND PRUSSIC ACID POTENTIAL. Agron. J. 56(6): 532-537. 1964.

Five aftermath cutting managements of Piper sudangrass, each at five levels of nitrogen fertilization, were studied in relation to their effect on yield, predicted digestibility, protein and amino acid content, and prussic acid potential.

Cutting at the early vegetative stages of growth resulted in lower dry matter yields and higher digestibility, protein, and amino acid levels in comparison to cutting at later stages of maturity. Predicted yields for a 60-day period were highest for digestible dry matter between the 24-inch and the head emergence stages of growth, and for protein at the 18-inch vegetative stage. Amino acid levels decreased from the early vegetative to the full-bloom growth stages.

Nitrogen fertilization increased yields for all cutting managements, and increases were greater at the more advanced stages of maturity. Crude protein content and apparent protein digestibility were increased markedly by nitrogen fertilization, as was the level of amino acids in the plant. Nitrogen fertilization had little effect on the predicted digestible energy content of the sudangrass.

Marked differences between estimations of digestible energy as calculated from chemical composition data and in vitro determinations were noted for two of the five growth stages studied.

The measurement of prussic acid potential indicated higher levels at the early growth stages and under higher levels of nitrogen fertilization. In none of the treatments examined was the prussic acid potential thought to be of danger to livestock.

W. Va. U. Agr. Expt. Sta., Morgantown, W. Va., 26506

117. Reid, R. L., Clark, B., and Jung, G. A. STUDIES WITH SUDAN GRASS: II. NUTRITIVE EVALUATION BY IN VIVO AND IN VITRO METHODS. Agron. J. 56(6): 537-542. 1964.

The effect of stage of growth and nitrogen fertilization on the nutritive value of Piper sudangrass fed in the green form to sheep was studied during 1960-61.

The digestibility of dry matter in the vegetative stage of the first growth was 72 percent in 1960 and 77-79 percent in 1961. Thereafter, there was a gradual decline in digestibility, of approximately 0.32 percent per day, over the first 6 weeks of growth. There was an even more marked fall, from values of 81-85 percent in the vegetative state, in the apparent digestibility of protein. These trends were paralleled closely by a decline in ad libitum intake of dry matter with increasing maturation of the forages.

An increased rate of nitrogen application in the 1961 trials (300 pounds as compared with 100 pounds) had no significant effect on the dry matter digestibility of the sundangrass cut at different growth stages. There was, however, a statistically significant increase in the apparent digestibility of protein due to the high nitrogen level.

Calculation of a Nutritive Value Index (N.V.I.) incorporating both digestibility and intake measurements, indicated a marked effect of plant growth stage on feeding value.

Sudangrass harvested in the vegetative and boot stages was calculated to meet the energy requirements of stall-fed yearling sheep at approximately twice the maintenance level. Forage fed at later growth stages supplied little more than maintenance requirements. Regrowth sudangrass in the vegetative to early heading phases had N.V.I. values approaching those of early-cut forages in the first growth cycle.

In vitro studies with the 1960 forages indicated a highly significant correlation between *in vivo* dry matter of cellulose digestibility and similar coefficients determined at 36 hours in the artificial rumen. A tendency for a higher *in vitro* digestibility with a hay-inoculum than with a grass-inoculum was not statistically significant. Rate determinations, utilizing either an *in vitro* cellulose digestion or gas production technique, showed that not only animal digestibility, but intake and N.V.I. values as well, were related significantly to *in vitro* indices determined at 12, 24, or 36 hours.

W. Va. U. Agr. Expt. Sta., Morgantown, W. Va., 26506

118. Stickler, F. C., Pauli, A. W., and Johnson, J. A. RELATIONSHIP BETWEEN GRAIN PROTEIN PERCENTAGE AND SEDIMENTATION VALUE OF FOUR WHEAT VARIETIES AT DIFFERENT LEVELS OF NITROGEN FERTILIZATION. Agron. J. 56(6): 592-594. 1964.

Variety and N fertilizer level significantly affected protein content and sedimentation value of hard red winter wheat. Interactions of variety X N fertilizer level for both protein content and sedimentation value were nonsignificant. There was evidence that increments of N fertilizer caused both protein content and sedimentation value of wheat to increase. However, at the highest level of N fertilizer, while the nitrogen content of the wheat increased, the sedimentation value did not. There may be an upper limit of the ability of wheat to utilize nitrogen in production of true gluten proteins.

Correlation between protein content and sedimentation value was generally highly significant for each variety. However, in some cases, a nonsignificant relationship between protein content and sedimentation value suggested that other factors were affecting the swelling power of the proteins subjected to an acid environment.

Agr. Expt. Sta., Kans. State U., Manhattan, Kans., 66504

119. Toman, F. R., and Pauli, A. W. CHANGES IN NITRATE REDUCTASE ACTIVITY AND CONTENTS OF NITRATE AND NITRITE DURING COLD HARDENING AND DEHARDENING OF CROWNS OF WINTER WHEAT (*TRITICUM AESTIVUM* L.). Crop Sci. 4(4): 356-359. 1964.

Changes in nitrate reductase activity, nitrate, nitrite, and total nitrogen content of crowns of three varieties of winter wheat were compared during cold hardening and dehardening.

Cold hardiness, measured as specific conductance, showed Minturki hardiest, Pawnee intermediate, and Ponca least hardy.

Concentrations of nitrate were high in all three varieties prior to hardening, decreased during hardening, and remained low during the period of greatest hardiness. Generally the highest level of nitrate was found in Ponca and the lowest in Minturki.

Correlations between nitrate content and nitrate reductase activity were nonsignificant. Highly significant correlations were found between nitrate content and specific conductance values.

Levels of nitrite in the plants were very low and differences among varieties were generally not significant.

Total nitrogen was always higher in Ponca than in the other two varieties. Difference between Minturki and Pawnee were usually not significant. Correlation between total nitrogen and nitrate in Minturki was significant and closely approached significance in the other two varieties.

Three trends were noted in nitrate reductase activity: (1) A general decrease during early hardening; (2) a general increase during maximum hardiness; and (3) a general decrease during the later stages of dehardening. No significant correlation was found between specific conductance and nitrate reductase activity or between nitrate reductase activity and water-soluble protein.

Jr. Author, Kans. Agr. Expt. Sta., Kans. State U., Manhattan, Kans., 66504

120. Dybing, C. D. INFLUENCE OF NITROGEN LEVEL ON FLAX GROWTH AND OIL PRODUCTION IN VARIED ENVIRONMENTS. Crop Sci. 4(5): 491-494. 1964.

The influence of N on the vegetative growth, flowering, boll production, oil content, and oil quality of three flax varieties was studied under field, greenhouse, and controlled environments. Vegetative growth and boll production were highly responsive to increased levels of N in nutrient culture. Boll production increased directly with the level of N in the solution, and was markedly reduced by cessation or reduction of the nutrient supply at flowering.

Oil content and iodine value were significantly reduced by applications of N in field and controlled environments. The decreased iodine value reflected a reduction in the percentages of linolenic and linoleic acids in the oil and increased percentage of oleic acid. The weights of linoleic and linolenic acids per 1,000 seeds of Arny flax were decreased, but the weight of oleic acid was not significantly altered as the level of N in the nutrient solution was increased from 28 to 224 p.p.m.

Plants receiving 60 pounds of N per acre in the field continued flowering later into the growing season than did unfertilized plants. The seeds produced late in the season exhibited lower seed weight, oil content, and iodine value than did seeds set in the early flush of flowers.

CRD, ARS, USDA, Brookings, S. Dak., 57007

121. Griffith, W. K., Teel, M. R., and Parker, H. E. INFLUENCE OF NITROGEN AND POTASSIUM ON THE YIELD AND CHEMICAL COMPOSITION OF ORCHARDGRASS. Agron. J. 56(5): 473-475. 1964.

Orchardgrass fertilized factorially with three levels each of nitrogen and potassium was harvested every 5-1/2 weeks throughout the growing season. Yield and chemical composition of the herbage were used as the criteria for evaluating the influence of the fertility treatments.

Nitrogen increased yields for all harvests, while potassium increased yield significantly only at the third harvest and at the N_0 level of the first harvest. Both nutrients reduced the percent total fructose for the first two growth periods. Potassium reduced percent total fructose during the third growth period; however, nitrogen fertilization caused a slight increase.

Application of potassium significantly increased the potassium content of the leaf tissue. Nitrogen fertilization accentuated a potassium deficiency, presumably due to excess potassium removal. This deficiency was associated with an abnormal asparagine accumulation in the plant tissue. When nitrogen fertility was not limiting, there was a highly significant negative correlation between the potassium and the asparagine content of the herbage.

Amer. Potash Inst., 1102 Sixteenth St. N.W., Washington, D.C., 20036

122. Gingrich, J. R. RELATIONSHIP OF SOIL TEMPERATURE, WATER SOLUBLE PHOSPHORUS IN APPLIED FERTILIZER, AND METHOD OF PLACEMENT TO GROWTH OF WINTER WHEAT. Agron. J. 56(6): 529-532. 1964.

Winter wheat was grown in the greenhouse for 24 days under controlled soil temperature conditions of 50°, 60°, and 70° F. Fertilizer materials in which either 30 percent, 54 percent, or 100 percent of the phosphorus was water soluble were mixed with the soil or applied in a zone below the seed.

The addition of phosphate did not increase the top growth when soil temperatures were maintained at 50° F. However, phosphate applications did increase greatly the percentage of phosphorus in the tops and the total yield of phosphorus for those plants grown at a 50° F. soil temperature.

Soil temperatures of 60° and 70° F. as compared to a soil temperature of 50° F. increased yield of dry matter, total yield of phosphorus, percentage of potassium in the tops, and decreased the percentage of phosphorus and nitrogen in the tops.

Confining the phosphate fertilizer to a zone rather than mixing it with the entire soil increased yields of dry matter, phosphorus percentage, total yield of phosphorus, and decreased potassium percentage in the tops.

In general, the higher the percentage of water-soluble phosphorus in the phosphate fertilizer the greater the amount of top growth, the higher the phosphorus percentage in the tops, and the greater the total yield of phosphorus.

The method of placement X phosphorus carrier and the method of placement X soil temperature interactions were not significant except for total yield of phosphorus.

Okla. State U. Expt. Sta., Stillwater, Okla., 74075

123. Harper, H. J., and Reed, L. W. EFFECT OF CHEMICAL COMPOSITION OF SOIL ON MICRONUTRIENTS AND OTHER ELEMENTS IN OKLAHOMA FORAGE PLANTS. Okla. State U. Expt. Sta. Processed Series P-486, 60 pp. 1964.

One hundred sixty seven samples of native prairie grass, cultivated grasses, and legumes were collected in early June from meadows and pastures in Oklahoma. A composite surface soil sample was also collected from each area when a forage sample was obtained. The forages were analyzed for nitrogen, phosphorus, potassium, calcium, magnesium, boron, cobalt, copper, iron, manganese, molybdenum, nickel, and zinc. The soils were analyzed for pH, total organic matter, total nitrogen, total phosphorus, exchangeable calcium, exchangeable potassium, and total exchangeable bases. Each soil was extracted with 0.2 normal sulfuric acid to determine easily soluble phosphorus and trace elements except iron.

The average phosphorus content of the prairie grass was 0.092 percent. The boron in the soil was probably adequate for the growth of grass but would be expected to be deficient for the optimum growth of some legumes on about 20 percent of the soils. About half of the prairie grasses contained less than 0.1 p.p.m. of cobalt. Only two of the soils from areas where prairie grass samples were collected contained less than 0.2 p.p.m. of dilute sulfuric acid-soluble cobalt.

The average nitrogen content of the prairie grasses was 1.18 percent. There was no relation between total nitrogen in the soil and nitrogen content of prairie grass.

About 5 percent of the prairie grasses were deficient in copper, and none were deficient in iron. Twenty percent of these grasses were on neutral and alkaline soils and contained less than 10 p.p.m. of manganese.

The molybdenum content of five prairie grass samples was less than 0.25 p.p.m. Nickel was not present in a toxic concentration in any of the grasses, and the quantity of zinc was probably adequate.

Nitrogen and phosphorus in bermudagrass were closely related, respectively, to total nitrogen and easily soluble phosphorus in the soil. Two buffalo grass samples were low in manganese, and one sample was high in molybdenum and copper. The manganese content of four of the miscellaneous grasses was below 10 p.p.m.

Five of the alfalfa samples contained less nitrogen than is normally present in alfalfa hay, and two alfalfa samples indicated a soil phosphorus deficiency.

The colbalt content of 9 of the 20 legume samples was less than 0.1 p.p.m. The iron, manganese, and zinc content of all samples was high except for one sample of sweet clover that was low in manganese and one sample of alfalfa that was low in zinc.

Tables.

Okla. State U. Expt. Sta., Stillwater, Okla., 74075

124. Leaf, A. L., and Watterston, K. G. CHEMICAL ANALYSIS OF SUGAR MAPLE SAP AND FOLIAGE AS RELATED TO SAP AND SUGAR YIELDS. Forest Sci. 10(3): 288-292. 1964.

Relating sap and sugar yields of Acer saccharum Marsh to sap and foliage nutrient composition indicated that: (1) Sugar yield per tree may be significantly predicted from d. b. h. and sugar concentration; (2) sap nutrient composition changed within the flow season; (3) sugar and nutrient levels in midseason sap differed primarily between high and low sugar producing trees; (4) relations between sun and shade foliage ash and P concentrations differed significantly among trees of various sugar yields; (5) young sun foliage ash concentrations and contents, and N, K, and Ca contents differed significantly among trees of various sugar yields; and (6) P concentrations of sun foliage just prior to leaf-fall differed significantly among trees of various sugar yield. Significant relations of sugar yield to foliage N, P, K, and Ca levels may indicate relationships between winter-stored nutrients, initial spring growth, energy transformations concerned with the sugar-starch-sugar cycle, and foliage nutrient element composition.

N.Y. State U., Syracuse U., Syracuse, N.Y., 13202

125. Lindsey, M. M. THE EFFECT OF HARVESTING CONDITIONS ON COTTON QUALITY IN THE YAZOO-MISSISSIPPI DELTA. Miss. Agr. Expt. Sta. B. 695, 40 pp. 1964.

Almost three-fourths of the Delta cotton crop is now harvested by mechanical means. Increased use of mechanical pickers plus continued use of available hand labor has caused some severe bottlenecks at many gins in the Delta during the last few ginning seasons. About 20 percent of the hand-picked cotton was ginned in the early season, 50 percent in the middle season, and about 30 percent in the late season. Less than 10 percent of the machine-harvested cotton was processed in the early season, almost 80 percent during the middle season, and just under 15 percent in the last season.

A comparison of the effect that harvesting conditions had on factors selected to measure cotton quality for hand- and machine-picked cotton indicated that grade favored hand-picked cotton in all three ginning seasons, but never by as much as a full grade. Staple length was greater in hand-picked cotton during early and middle ginning seasons, but favored machine-picked cotton in the late season. Gin turnout was higher for machine-picked cotton during early and late ginning seasons, but was slightly less than hand-picked cotton during the middle season. There was more gin waste in machine-picked cotton during early and middle ginning seasons, but hand-picked cotton exhibited more waste during the late season.

When area and harvesting conditions were ignored, the differences in quality become less apparent. Cotton grade was higher for hand-picked cotton, but by the small margin of 2-1/2 index points. Gin turnout was better for the machine-picked cotton where 1,553 pounds of seed cotton produced 500 pounds of lint as compared to the 1,583 pounds of hand-picked seed cotton required for 500 pounds of lint. Staple length, percentage of seed turnout, and percentage of ginning waste were almost identical for the two methods of harvesting.

When all factors were considered, there seemed to be little difference in the effect ginning had on the factors that affected lint value for either hand- or machine-picked cotton.

Miss. State U., Agr. Expt. Sta., State College, Miss., 39762

126. Eilrich, G. L., Long, R. C., Stickler, F. C., and Paul, A. W. STAGE OF MATURITY, PLANT POPULATION, AND ROW WIDTH AS FACTORS AFFECTING YIELD AND CHEMICAL COMPOSITION OF ATLAS FORAGE SORGHUM. Kans. Agr. Expt. Sta. Tech. B. 138, 23 pp. 1964.

A study was conducted at Manhattan, Kans., in 1961-63 to determine the trends in carbohydrates, fiber, protein, and dry matter accumulation in Atlas forage sorghum as affected by stage of maturity and differences in planting systems. In 1961-62, 40-inch and 20-inch row widths were evaluated by populations of 104,500 plants per acre (high); 26,100 plants per acre(medium); and 13,100 plants per acre (low). In 1963, the study was revised to determine the effect of stage of maturity and two management systems (thickly drilled in 10-inch rows with 523,000 plants per acre versus 40-inch rows with 39,000 plants per acre) on yield and chemical composition.

The authors concluded that:

1. High populations were superior in total yield per acre of dry matter, protein, and carbohydrates, but they also produced a greater amount of fiber.
2. Narrow rows were superior to 40-inch rows in forage yield per acre.
3. Yield of dry matter, carbohydrates, protein, and fiber continued to increase from anthesis until frost.
4. Although dry-matter yield was increased by delayed harvest, digestibility of the silage may be decreased because of increased hardness of the seed and increased fiber content of the plant.

Tables and charts.

Kans. Agr. Expt. Sta., Kans State U., Manhattan, Kans., 66504

127. Guenzi, W. D., Kehr, W. R., and McCalla, T. M. WATER-SOLUBLE PHYTOTOXIC SUBSTANCES IN ALFALFA FORAGE: VARIATION WITH VARIETY, CUTTING, YEAR, AND STAGE OF GROWTH. Agron. J. 56(5): 499-500. 1964.

Forage samples from Buffalo and Ranger alfalfa at 3 cuttings and at 6 stages of growth were extracted with distilled water, using 1 part of dry plant material to 15 parts of water. Effects of these water-soluble extracts were tested on corn germination and growth of roots and shoots.

All extracts contained water-soluble substances that reduced shoot and root growth of corn seedlings. Varieties did not differ with respect to phytotoxicity of water extracts. Extracts from various stages of growth and cuttings differed significantly in their effects on root growth, with the 10-inch stage of growth being most phytotoxic. The effect of the extracts on shoot growth differed significantly between years and time of cutting. Amount of water-soluble material from dry, ground alfalfa forage was significantly different among stages of growth.

SWCRD, ARS, USDA, Lincoln, Nebr., 68503

128. Burns, J. C., and Wedin, W. F. YIELD AND CHEMICAL COMPOSITION OF SUDANGRASS AND FORAGE SORGHUM UNDER THREE SYSTEMS OF SUMMER MANAGEMENT FOR LATE FALL IN SITU UTILIZATION. Agron. J. 56(5): 457-460. 1964.

Piper sudangrass and forage sorghum (RP30F) were evaluated under different summer managements with respect to suitability for summer and late-fall in situ utilization. Frequency of summer cuttings and regrowth obtained prior to frost directly influenced the quantity and quality of forage saved for fall use.

Forage saved for fall use incurred no significant change in yield of dry matter and percent crude protein within each management from the first (October 29) to the last fall harvest (November 28). Percent crude fiber showed a significant linear increase for this period.

In general, forage sorghum yielded significantly higher dry-matter yields, resulted in significantly higher percent crude protein, contained higher prussic acid (HCN) levels, but resulted in significantly lower percent crude fiber than did sudangrass.

Considering aspects of yield and nutritive value and including estimates of animal utilization of available forage, either aftermaths of once-harvested sudangrass or forage sorghum should provide suitable forage for late fall in situ utilization.

Stockpiled forage sorghum possessed certain qualities needed in forage saved for fall use. Harvesting as fodder, silage, or some type of gathering in the field would be needed to effect a reasonable level of utilization by livestock.

Purdue U., Lafayette, Ind., 47907

Soil Classification

SEE ALSO 6, 37, 44, 48, 54, 60, 61, 65, 67, 68, 69, 77, 78, 79, 81, 86, 87, 88, 89, 90, 91, 96, 97, 110, 112, 123, 147, 151, 170, 174, 175, 176, 194, 195, 196, 199, 212, 219, 228, 232, 240, 258, 263, 265, 266, 267, 270, 272, 285, 290, 310.

129. Rozmakhov, I. G., Serova, P. P., and Yurkina, S. M. EFFECT OF FORESTS ON MICROCOMPLEXITY OF SOILS. Soviet Soil Sci. 12: 1131-1135. Dec. 1963.

In a study of the effect of forests on the microcomplexity of soils, the author concluded that:

1. Because of windfall phenomena, trees play a major role in dispacement of the soil and formation of the microrelief.
2. Along with considerable variation in particle size composition due to windfall phenomena, there is a difference in the distribution of the clay fraction and microaggregate composition under different trees.
3. The specific nature of the exchange of substances between the soil and vegetation is partly reflected in the chemistry of the soil profile under trees of various species.

4. An important role in formation of the soil profile under various species of trees is played by the focal nature of the microecological conditions, especially the entry and removal of moisture.
5. Partly reversible processes occur in connection with the succession of species under different habitats, and these must be taken into account in elucidating the genesis of the forest soil profiles in carrying out forestry practices.

Scripta Technica, Inc., 1000 Vermont Ave., N.W., Washington, D.C., 20005

130. Kahle, C. F. POSSIBLE ROLES OF CLAY MINERALS IN THE FORMATION OF DOLOMITE. J. Sedimentary Petrology 35(2): 448-453. 1965.

Evidence is accumulating which strongly suggests that clay minerals effect the formation of some dolomites in soils. Clays may behave somewhat as catalysts by providing a source of magnesium ions or by serving as membrances which effect ionic migration. Alternately, clays may assume a more active role in dolomitization by serving as centers of nucleation or by entering into chemical reactions which involve dolomite as one of the products.

U. Toledo, Toledo, Ohio, 43606

131. McCracken, R. J., Weed, S. B., and Goldston, E. F. PLANOSOLIC PIEDMONT SOILS OF NORTH CAROLINA: I. MORPHOLOGY AND COMPOSITION. Soil Sci. 98(1): 4-8. 1964.

Iredell and White Store are planosolic soil series common in the Piedmont physiographic region of North Carolina, South Carolina, and Virginia. These are problem soils because of their physical characteristics of high contents of plastic clay in B horizons under thin A horizons, with restricted internal drainage. These soils represent extremes with respect to clay accumulation in B horizons. The Iredell soil series is estimated to occupy 370,000 acres and the White Store 200,000 acres in North Carolina. In a chemical study of these soils the authors concluded that:

1. Iredell and White Store soils are similar in physical characteristics, such as sandy surface soils and high content of clay in B horizons, but differ markedly in chemical properties. Iredell soils have high "base status," whereas White Store soils have high exchangeable Al saturation.
2. Both Iredell and White Store soils were found to have exchangeable Mg contents higher than exchangeable Ca. The high content of weatherable minerals in the solum maintains high exchangeable basic cation populations in the Iredell soils.
3. Both Iredell and White Store soil series were found to possess only a few illuviation argillans in B horizons despite the high B/A clay ratios and the field description of clay films. Stress cutans ("pressure faces") were in both soils, reflecting swelling activity of B horizon clays.
4. Iredell is placed in the Albaqualic Normudalf subgroup and White Store in the Aquic Normochrult subgroup in the newly proposed (7th Approximation) classification system.

Soil profile descriptions, maps, and tables.

Agr. Expt. Sta., N.C. State Col., Raleigh, N.C., 27607

132. Grossman, R. B., Odell, R. T., and Beavers, A. H. SURFACES OF PEDS FROM B HORIZONS OF ILLINOIS SOILS. Soil Sci. Soc. Amer. Proc. 28(6): 792-798. 1964.

Surfaces of peds from B horizons of several Illinois soils were studied. Concepts of "structural specific surface" and of "disparity" between the ped surface and ped interior were presented. The ped surfaces were described in terms of accretive (accumulation) and degradational (removal) alteration classes. Aspects of the moisture regime at the ped surface were discussed.

Ped surfaces were sampled by washing kerosene-saturated peds with Calgon solution. Clay in the ped surface generally had more fine clay (<0.04μ) and more coarse clay (>0.5μ) than clay from bulked (whole) peds. Collapse from 14Å to 10Å was less complete on heating to 450° C. for the clay from the ped surface. In samples of peds with significant percentages of both montmorillonite and nonexpanding 2:1 lattice clays, the predominantly accretive ped surfaces had more mortmorillonite than the bulked peds had, whereas predominantly degradational ped surfaces had less.

Soil Survey Lab., SCS, USDA, Lincoln, Nebr., 68503

133. White, E. M. AGE RELATIONSHIP OF WAVY-GILGAIED AND NONGILGAIED SOILS IN WESTERN SOUTH DAKOTA. Soil Sci. Soc. Amer. Proc. 28(6): 798-801. 1964.

The incidence of wavy-gilgaied, nongilgaied-Chestnut, and lithosolic soils formed from Pierre shale was estimated at intervals in a creek valley by a transect method to test the concept that the three soils form a chronosequence.

Recent geologic erosion was found to decrease progressively up the valley. The distribution of both the wavy-gilgaied soil and the lithosolic soil in the valley was significantly related to the extent of the recent geologic erosion. The distribution of nongilgaied-Chestnut soils was not significantly related to the amount of erosion along the valley. Wavy-gilgaied soils were most abundant where erosion was least and thus the soil age was greatest, whereas Lithosols were most abundant where erosion was greatest and thus the soil age was least. Chestnut soils occurred in both locations, presumably where the soil age was intermediate.

S. Dak. State Col., Brookings, S. Dak., 57007

134. Armstrong, J. E., Crandell, D. R., Esterbrook, D. J., and Noble, J. B. LATE PLEISTOCENE STRATIGRAPHY AND CHRONOLOGY IN SOUTHWESTERN BRITISH COLUMBIA AND NORTHWESTERN WASHINGTON. Geol. Soc. Amer. Bul. 76(3): 321-330. 1965.

Six geologic-climate units were preposed for the late Pleistocene sequence in southwestern British Columbia and northwestern Washington. They included two major units—the Olympia Interglaciation and the Fraser Glaciation—and four subdivisions of the latter—the Evans Creek, Vashon, Sumas Stades, and the Everson Interstade.

The Olympia Interglaciation is a nonglacial episode that started at least 36,000 years B.P. and continued until the advance of Cordilleran glacier ice during the Fraser Glaciation.

During the Evans Creek Stade, alpine glaciers formed in the mountains of western Washington and British Columbia while nonglacial sediments were still being deposited in the southern Puget Lowland.

Further growth of glaciers in British Columbia resulted in the formation of the Cordilleran ice sheet. This ice entered the northern end of the area after 25,000 years B.P. but did not reach the southern end until after 15,000 years B.P.

The Vashon Stade of the Fraser Glaciation began with this advance of Cordilleran ice into the lowlands. It ended with the beginning of marine and glaciomarine conditions there, which commenced in the southern Puget Lowland about 13,500 years B.P. and in the Strait of Georgia about 13,000 years B.P.

The episode represented by the marine conditions is called the Everson Interstade and lasted about 2,000 years, during which the sea contained much floating ice.

The Interstade ended when the land rose with respect to the sea level, forcing withdrawal of the sea and the disappearance of floating ice in most of northwestern Washington and southwestern British Columbia; in the eastern part of the Fraser Lowland this event coincided with the advance of a valley glacier during the Sumas Stade.

Geol. Survey Canada, Vancouver, British Columbia, Canada.

135. Bailey, H. H. FRAGIPAN SOILS: MORPHOLOGICAL RELATIONSHIPS. Soil Sci. Soc. Amer. Proc. 28(5): 680-683. 1964.

Field descriptions and certain laboratory data for 17 soil profiles representing Budford, Calloway, Dickson, Grenada, Henry, Mercer, and Tilsit series in Kentucky were obtained. All of the soils contain fragipan horizons. Each genetic horizone of each profile was characterized by morphological description, including pH.

Greatest thickness of pan development occurred in the poorly and somewhat poorly drained loessial soils; moderately well-drained sites from loess-free limestone residuum were third; moderately well-drained mixed sandstone, shale, and siltstone residuum fourth; and moderately well-drained deep loess least. The poorer the drainage the greater the pan development in deep loess. Colors in the pan horizons tended to differ from those above by having more yellowish hues and depressed chroma. Pan horizons generally contained more clay and correspondingly less silt than did the horizon above the pan. Pans were generally more acid, ranging around pH 5, than were horizons above or below. Pans tend to reversibly lose their characteristic consistency under wet conditions.

Ky. Agr. Expt. Sta., Lexington, Ky., 40506

136. Hutcheson, H. T., Jr., and Bailey, H. H. FRAGIPAN SOILS: CERTAIN GENETIC IMPLICATIONS. Soil Sci. Soc. Amer. Proc. 28(5): 684-685. 1964.

A study of a number of fragipan soils derived from a wide range of parent materials was undertaken to test a hypothesis concerning fragipan formation. The hypothesis was based on data obtained from loessial soils. Particle size distributions and selected chemical properties were determined, and comparisons of the data for the B_x and adjacent horizons were made. The portion of the original hypothesis suggesting that fragipan soils were severely leached prior to pan formation and that pan formation resulted from tight packing of dispersed clay particles, was acceptable with certain limitations. On the other hand, it was not accepted that Ca:Mg or Ca:Mg + Na ratios were factors of general importance in fragipan formation.

Ky. Agr. Expt. Sta., Lexington, Ky., 40506

137. White, E. M. THE MORPHOLOGICAL-CHEMICAL PROBLEM IN SOLODIZED SOILS. Soil Sci. 98(3): 187-191. 1964.

The morphological-chemical relationship was complex in solodized soils. For study purposes, these soils were grouped into lithosequences, chronosequences, and toposequences. In addition, they were classed into groups which intergrade to other kinds of soils such, as those of the planosol or Chestnut great soil groups.

Because the morphological characteristics seem to be as dependent on the entire genetic environment as on the exchangeable-sodium status, the latter cannot be estimated independently from other soil-formation factors. Minor morphological characteristics appeared to be more indicative of the exchangeable-sodium percentage than major features. Preliminary studies indicated that these minor morphological characteristics were related to the chemical status in a particular genetic environment.

S. Dak. State Col., Brookings, S. Dak., 57007

138. White, E. M. MORPHOLOGICAL-CHEMICAL RELATIONSHIPS OF SOME THIN A HORIZON SOLODIZED SOILS DERIVED FROM MODERATELY FINE MATERIAL ON A WELL-DRAINED SLOPE. Soil Sci. 98(4): 256-263. 1964.

Extractable sodium in the B_2 horizon of well-drained solodized soils derived from moderately fine-textured Tertiary-age shale can be estimated from the morphological characteristics, even though the columns are well developed and do not appear to be degrading at a rapid rate. Subangular peds are stronger than the prisms in the lithosolic intergrade, weaker than the columns in soils with considerable sodium, and stronger than the columns where the sodium content is low. Subsequently, prisms stronger than the subangular peds apparently are formed from the colums as the A_2 horizon is incorporated into the A_1 horizon and the soil changes to a Chestnut.

In solodized soils, clay may move from the A horizon before the columns are formed. Thus the A horizon of some solodized-solonetz soils may develop initially and the degradation of the columns would be only a secondary importance in determining the A horizon thickness.

Agr. Expt. Sta., S. Dak. State Col., Brookings, S. Dak., 57007

139. Hugie, V. K., and Passey, H. B. SOIL SURFACE PATTERNS OF SOME SEMIARID SOILS IN NORTHERN UTAH, SOUTHERN IDAHO, AND NORTHEASTERN NEVADA. Soil Sci. Soc. Amer. Proc. 28(6): 786-792. 1964.

Surface soil patterns were classified and studied on 70 semiarid to subhumid areas with relict native vegetation in Utah, Idaho, and Nevada. Three general classes of soil surface conditions were recognized—prominently patterned, weakly patterned, and unpatterned. Prominent and weak patterns were further classified into polygonal surface soil patterns with and without segregation of coarse particles.

Surface patterns were found to occur only on bare surface soil between clumps of plants on well-drained and moderately well-drained silt loam, silty clay loam, and very fine sandy loam textured soils. Polygonal patterns with segregated coarse particles were observed only on moderately well-drained planosolic, lithosolic, and solonetzic soils containing basalt pebbles. Surface soil patterns did not occur under vegetation, mulch, stones, or gravel.

Cycles of alternate freezing and thawing of the surface soil followed by desiccation result in the formation of polygonal surface soil patterns with and without segregation of coarse particles.

SCS, USDA, Salt Lake City, Utah, 84111

140. Wilding, L. P., Schafer, G. M., and Jones, R. B. MORLEY AND BLOUNT SOILS: A STATISTICAL SUMMARY OF CERTAIN PHYSICAL AND CHEMICAL PROPERTIES OF SOME SELECTED SOIL PROFILES. Soil Sci. Soc. Amer. Proc. 28(5): 675-679. 1964.

Statistics including the mean, range, coefficient of variation, and standard deviation were reported for particle-size distribution, organic matter content, calcium carbonate equivalent, pH, depth of leaching, soil color, grade of soil structure, horizon thickness, and depth to mottling for 21 Morley and 38 Blount soil profiles sampled in Ohio. Of these properties, composite horizon thickness, hue and value variables of color, depth of leaching of free carbonates, silt content, and total clay content were least variable.

The number of profile samples required to estimate the population mean of the above parameters within ± 10 percent using a 0.95 cofidence interval was also computed. Cation-exchange data were presented for representative Morley and Blount profiles.

Ohio Agr. Expt. Sta., Wooster, Ohio, 43210

141. Horn, M. E., Rutledge, E. M., Dean, H. C., and Lawson, M. CLASSIFICATION AND GENESIS OF SOME SOLONETZ (SODIC) SOILS IN EASTERN ARKANSAS. Soil Sci. Soc. Amer. Proc. 28(5): 688-692. 1964.

Medium-textured Solonetz soils, comprising an estimated 600,000 acres in Arkansas, are extensively developed in loess and backwater alluvial deposits of eastern Arkansas. Three general groups are recognized: (1) Soils of less than about 10 inches depth to a sodic horizon; (2) soils with acid upper horizons and moderate depth (about 24 inches) to a sodic horizon; and (3) soils with sodic horizons and acid sola.

Laboratory analyses of Lafe and Foley soil profiles indicated that their sodic horizons contained high percentages of exchangeable Na (15 to 40 percent or more) and Mg (40 to 50 percent or more) with electrical conductivities ranging up to 5 mmho. per cm. These horizons are commonly characterized by prismatic or columnar structure. It appears that these soils are undergoing leaching and that soils of high exchangeable Na and solonetz morphology are probably the result of prior high Na content.

Ark. Agr. Expt. Sta., Fayetteville, Ark., 72701

142. Tedrow, J. C. F. PRODUCTIVE CAPACITY OF NEW JERSEY SOILS. N.J. Agr. Expt. Sta. B. 811, 88 pp. 1964.

The 215 soils of New Jersey were briefly described in nontechnical terms, and a few pertinent statements were made concerning their agricultural potential, adaptations, and limitations. All kinds of soils were placed into one of the following six groups as to their suitability for agriculture:

Group A — Very productive farmland; suitable for permanent cultivation. With proper management, yields tend to be high.
Group B — Good farmland; suitable for permanent cultivation. Generally, yields are good.
Group C — Fair farmland; suitable for permanenet cultivation but yields tend to be lower than those in group A or B. The limiting factors are usually shallowness, droughtiness, excessive moisture, etc.
Group D — Rather poor farmland; ususally wet, stony, droughty, or otherwise unsuitable for permanent cultivation.
Group E — Very poor farmland for tillage because of excessive water, shallowness, stoniness, droughtiness, etc.
Group F — Land unsuitable for agriculture. This consists of rock outcrop, rough stony land, coastal beaches, and clay pits.

This grouping does not take into consideration improved roads, highways, powerlines, water supply and related conditions, nearness to markets, topography, soil erosion, degree of slope, the general tilth of the soil that the farmer maintains, individual farming skills, or the size and condition of farm buildings.

Many wet soils have been assigned to one of two groups—one if the soils are in their natural state, and another if the soils have been artificially drained.

This guide has been compiled as an aid to assessors in connection with evaluating farmland in New Jersey under the Farmland Assessment Act of 1964.

N.J. Agr. Expt. Sta., Col. Agr. Rutgers—The State U., New Brunswick, N.J., 08903

143. Soil Conservation Service. SOIL SURVEY: * U.S. Dept. Agr., Soil Conserv. Serv. **

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BALDWIN COUNTY, ALABAMA	110 pp.	Dec. 1964.
HOLBROOK-SHOW LOW AREA, ARIZONA	79 pp.	Apr. 1964.
EASTERN STANISLAUS AREA, CALIFORNIA	160 pp.	Sept. 1964.
SPAULDING COUNTY, GEORGIA	65 pp.	Oct. 1964.
TREUTLEN COUNTY, GEORGIA	79 pp.	Jan. 1964.
WALTON COUNTY, GEORGIA	70 pp.	Dec. 1964.
WABASH COUNTY, ILLINOIS	84 pp.	Feb. 1964.
OWN COUNTY, INDIANA	121 pp.	Oct. 1964.
ADAIR COUNTY, KENTUCKY	127 pp.	Apr. 1964.
CLARK COUNTY, KENTUCKY	114 pp.	Oct. 1964.
FULTON COUNTY, KENTUCKY	72 pp.	Aug. 1964.
AROOSTOOK COUNTY, MAINE: NORTHEAST PART.	80 pp.	Apr. 1964.
CAROLINE COUNTY, MARYLAND	53 pp.	Jan. 1964.
JACKSON COUNTY, MISSISSIPPI	65 pp.	June 1964.
WARREN COUNTY, MISSISSIPPI	73 pp.	Nov. 1964.
MONITEAU COUNTY, MISSOURI	42 pp.	May 1964.
GAGE COUNTY, NEBRASKA	76 pp.	May 1964.
WASHINGTON COUNTY, NEBRASKA	79 pp.	Sept. 1964.
HOOKER COUNTY, NEBRASKA	41 pp.	Jan. 1964.
IREDELL COUNTY, NORTH CAROLINA	96 pp.	June 1964.
SARGENT COUNTY, NORTH DAKOTA	97 pp.	Jan. 1964.
OTTAWA COUNTY, OKLAHOMA	60 pp.	Nov. 1964.
STEPHENS COUNTY, OKLAHOMA	64 pp.	Nov. 1964.
SHERMAN COUNTY, OREGON	104 pp.	Nov. 1964.
JEFFERSON COUNTY, PENNSYLVANIA	91 pp.	Aug. 1964.
MINNEHAHA COUNTY, SOUTH DAKOTA	102 pp.	June 1964.
FAYETTE COUNTY, TENNESSEE	71 pp.	March 1964.
WILLIAMS COUNTY, TENNESSEE	147 pp.	Aug. 1964.
COCHRAN COUNTY, TEXAS	80 pp.	March 1964.
FOARD COUNTY, TEXAS	71 pp.	Nov. 1964.
YOAKUM COUNTY, TEXAS	53 pp.	March 1964.
WALLA WALLA COUNTY, WASHINGTON	138 pp.	Feb. 1964.
CRAWFORD COUNTY, WISCONSIN	85 pp.	Dec. 1964.
PEPIN COUNTY, WISCONSIN	141 pp.	March 1964.

These Soil Surveys were all published by the United States Department of Agriculture, Soil Conservation Service, in cooperation with the local State agricultural and/or other cooperating agencies. All contain maps in addition to written text.

SCS, USDA, Inform. Div., Washington, D.C., 20250.

EROSION CONTROL

Erosion Equation

144. Chepil, W. S., Siddoway, F. H., and Armbrust, D. V. WIND ERODIBILITY OF KNOLLY TERRAIN. J. Soil and Water Conserv. 19(5): 179-181. 1964.

The wind erosion equation for determining the conditions of soil cloddiness, soil surface roughness, vegetative cover, and width of field needed to reduce potential soil loss to a tolerable amount has been applicable so far only to a level terrain. An analysis of research data was given from which suggested guidelines were used for estimating the conditions required to reduce potential soil loss from other than level terrain.

F. H. Siddoway, SWCRD, ARS, USDA, Sidney, Mont., 59270.

Wind and Water Erosion

See Also 144, 310, 329.

145. Disher, M. E. PLASTIC FILM FOR EROSION CONTROL CHECKS. J. Soil and Water Conserv. 19(6): 234. 1964.

Substitution of polyethylene film for brush in small erosion control check dams cut labor costs in half and reduced total construction costs by almost 30 percent in recent trials conducted in Tennessee.

The new material for check dam construction was tested in the Beech River watershed in west Tennessee during cooperative efforts to control erosion from land above eight small impoundments. About 120 acres of public land were involved in these erosion control efforts.

The erosion control project involved erection of 1,175 check dams, ranging from 3 to 20 feet in length and 12 to 24 inches in height. Of this total, 590 dams were built with brush and 585 were constructed with plastic.

Posts and wire for a 10-foot-long check dam cost $4.00. Collecting brush and fashioning it into a check dam required 6.3 man-hours. Substitution of plastic film for the brush increased material costs $0.50, but reduced labor requirements to 3.2 man-hours.

Subjected to recent heavy rains, the plastic-film check dams have remained in good condition. All current evidence indicates they will control runoff adequately until vegetation becomes established.

Div. Forestry Develop., TVA, Norris, Tenn., 37828.

146. Judson, S., and Ritter, D. F. RATES OF REGIONAL DENUDATION IN THE UNITED STATES. J. Geophysical Res. 69(16): 3395-3401. 1964.

Data, in large part collected since World War II, allow a recalculation of the rates of regional erosion in the United States. These data indicate a rate of denudation for the United States as a whole of 2.4 in./1000 years, or about twice that of older estimates. The most rapid rate, 6.5 in/1000 years, was recorded from the Colorado drainage. The slowest rate, 1.5 in./1000 years, was found in the Columbia basin. Other drainage areas and their rates were the Pacific slopes, California, 3.6 in./1000 years; the western Gulf of Mexico, 2.1 in./1000 years; the Mississippi River watershed, 2.0 in./1000 years; the South Atlantic and the eastern Gulf of Mexico, 1.6 in./1000 years, and the North Atlantic, 1.9 in./1000 years.

Princeton U., Princeton, N.J., 08540.

147. Moldenhauer, W. C., and Long, D. C. INFLUENCE OF RAINFALL ENERGY ON SOIL LOSS AND INFILTRATION RATES: I. EFFECT OVER A RANGE OF TEXTURE. Soil Sci. Soc. Amer. Proc. 28(6): 813-817. 1964.

Soil and water losses were determined from sieved air-dry samples of five Iowa soils varying in texture, using a laboratory rain simulator with a 3-m. drop fall, a 4.85- to 5.00-mm. drop diameter, and an intensity ranging from 3.43 to 6.78 cm. per hour. The soil samples were contained in a pan 15.2 cm. deep, 30.5 cm. wide, 45.7 cm. long, and tilted to a 9 percent slope. Runs were 90 minutes in length.

The infiltration rate was the most important factor influencing total soil loss. Relative total soil losses for 90 minutes of run at high intensity were silty clay> silty clay loam>silt>loam>fine sand. At the low intensity, the positions of silty clay and silty clay loam and of silt and loam were reversed. Total soil loss varied with intensity, but infiltration was essentially constant over the entire range except on the fine sand. With equal water loss, the order of erodibility was fine sand>silty clay>silty clay>loam>silt>loam. Total kinetic energy required to initiate runoff was constant over a range of time and intensity.

SWCRD, ARS, USDA, Ames, Iowa, 50010.

Terracing

See 329.

Critical Areas

See Also 108, 365.

148. Bertrand, A. R., and Woodburn, R. A FRESH LOOK AT GULLY EROSION IN THE SOUTH. J. Soil and Water Conserv. 19(5): 173-175. 1964.

The erosion control job is not finished until adequate protection is afforded the land from the watershed rim down to a base level below which no erosion can occur. The gully erosion hazard is always present, even though erosion control measures may be completely effective on most of the land area involved.

To forestall the ruin of land areas, the choking of streams with sediment, and the destruction of conservation works by the process of gully erosion, farm planning and application of proven conservation techniques are essential. Thorough and continuous inspection of areas with potential erosion hazards, adequate maintenance of established conservation practices, and prompt use of measures to control incipient gully erosion are also vital. Gully erosion has had less attention from farmers and conservationists than must now be devoted to it if it is to be properly controlled under currently prevalent methods of crop production and grazing.

SWCRD, ARS, USDA, Athens, Ga., 30601.

149. Thor, E., and Kring, J. S. PLANTING AND SEEDING OF LOBLOLLY PINE ON STEEP SPOIL BANKS. J. Forestry 62(8): 575-576. 1964.

A study was made of planting versus seeding of loblolly pine on spoil banks with north and south exposures in the Cumerland Mountains of Tennessee.

After 3 years, both percent survival and percent stocking were better for planted trees than for directly seeded spots. However, due to the closer initial spacing of seeded spots, there was no difference in the total number of surviving trees in the two treatments. The main advantage of planting was a more uniform distribution.

Exposure did not have a statistically significant effect on survival, but planted and seeded trees grew much faster on spoil banks with a southern exposure.

Agr. Expt. Sta., U. Tenn., Knoxville, Tenn., 37901.

SOIL MANAGEMENT

Cropping Practices

See Also 29, 70, 168, 169, 234, 367.

150. Hinkle, D. A. FORTY YEARS OF CROP ROTATION AND FERTILIZATION. Ark. Agr. Expt. Sta. B. 693, 34 pp. 1964.

A 4-year rotation, fertilization, and lime experiment was begun in 1921 at Fayetteville, Ark., on soil classified as Zanesville and Waynesboro silt loams. The experiment was continued in modified form for 40 years.

The experimental plan provided: (1) Comparisons of rock phosphate and superphosphate alone and in the presence of lime, nitrogen, and potassium; (2) comparisons of superphosphate alone and with various combinations of lime, nitrogen, and potassium; and (3) comparison of combinations of lime, nitrogen, and potassium without either source of phosphorus.

The rotation used was corn, oats, wheat, and red clover hay. Some barnyard manure was applied to all plots at various times.

Rock phosphate and superphosphate both were applied to corn and wheat crops at 250 lb./A. Sodium nitrate was added to corn at 150 lb./A., and 75 lb./A. each on oats and wheat. Potassium chloride at 50 lb./A. was added to corn and wheat, and 1,000 lb./A. of limestone was applied to wheat.

The following conclusions were made:

1. There was a relationship between summer rainfall and corn yields over the 40 year period. The correlation coefficient was +0.73, and the regression line indicated an increase of 3.72 bushels of corn per acre for each inch of summer rainfall.
2. All crops gave greatest response to applications of phosphate.
3. When rock phosphate and superphosphate were used alone, superphosphate was a better source of phosphorus during the first two or three rotation cycles for both corn and oats. However, rock phosphate provided equal or better yields of corn and oats than superphosphate did during the remaining cycles. Superphosphate was a somewhat better source of phosphorus for wheat, and the two were about equal for red clover hay. The rock phosphate supplied from 1.6 to 2 times as much P_2O_5 per acre as did the superphosphate.
4. When the two phosphate sources were applied in the presence of lime, nitrogen, and potassium, the "catching up" of rock phosphate with superphosphate was delayed until the fourth rotation cycle for corn and the eighth cycle in the case of oats. Superphosphate was superior for both wheat and hay through nearly all rotation cycles.
5. Combinations of nitrogen and lime and of potassium and lime gave higher yields of corn, oats, and hay than the combination of nitrogen and potassium. The response probably was due to lime. No one of these combinations was superior for wheat.
6. Of the various combinations containing superphosphate, no one was better in the case of corn; however, for oats and wheat a combination of nitrogen and superphosphate, or of nitrogen, superphosphate, and lime frequently resulted in the highest yields.

Charts and tables.

Agr. Expt. Sta., U. Ark., Fayetteville, Ark., 72701

151. Hayslip, N. C., Hodges, E. M., Jones, D. W., and Kretschmer, A. E., Jr. TOMATO AND PANGOLAGRASS ROTATION FOR SANDY SOILS OF SOUTH FLORIDA. Fla. Agr. Expt. Sta. C. S-153, 24 pp. 1964.

Tomato farmers should re-evaluate the advantages of moving to virgin soil for each crop. After more than 20 years of moving to new land twice a year, some tomato growers are now forced to farm long distances from paved roads, farm shops, and markets. In addition, those growers are using poorer soil types which require more clearing and which are not as well adapted for drainage, irrigation, or cold protection.

Studies begun in 1950 indicated that rotation of pangolagrass pastures and tomatoes reduced or eliminated certain production problems that appeared or increased under continuous cropping of tomatoes or pangolagrass. In order to achieve the maximum benefits from such a rotation, the following suggestions were given:

1. DO: (1) Select an area with good soil that is properly leveled, has adequate water control, is in a warm location, and is easily accessible to the market; (2) plant a generous amount of well fertilized pangolagrass at the time tomatoes are laid-by or immediately following last tomatoe harvest; (3) mow weeds in newly planted pasture before they produce seeds; (4) fertilize pangolagrass with high nitrogen formulations in the spring and early summer; (5) level pangolagrass sprigged tomato beds while soil is moist and before beds become heavily sodded; (6) check pasture for nematodes and treat for soil insects before planting tomatoes; and (7) use a fusarium wilt-resistant tomato variety.
2. DON'T: (1) Attempt to plow or disk under heavy pangolagrass top growth in preparing pasture area for tomatoes; (2) overgraze, but maintain heavy grass cover at all times except just prior to disking; (3) allow invasion of clover or weeds; (4) plant pangolagrass or seed tomatoes in dry soil; (5) use rotation for summer-grown tomato crops; (6) wait too late to begin preparing pasture for tomatoes; and (7) forget to arrange for a plentiful supply of good quality pangolagrass for planting.

U. Fla., Agr. Expt. Sta., Gainesville, Fla., 32603

Soil Conserv. 29(12): 267-287. July 1964.

This issue of the Soil Conservation Magazine was devoted to articles on conservation practices. The following articles were given:

152. Williams, D. A. CONSERVATION TECHNOLOGY: MODERN METHODS KEEP PACE WITH TODAY'S FAST-CHANGING AGRICULTURE. SCS, USDA, Washington, D.C., 20250

153. Thorburn, G. P., and Hawk, V. B. CROWNVETCH REWARDS SKILL, CARE IN DISTRICT SEED PLOT. SCS, USDA, Ames, Iowa, 50010

154. Thomas, E. E. CONSERVATIONISTS FIND WAY TO IRRIGATE SALINE SOILS TO GROW PASTURE GRASSES. SCS, USDA, Pecos, Tex., 79772

155. Edmister, F. C. CARRYING CAPACITY FOR RECREATION APPLIES BASIC IDEAS IN NEW SETTING. SCS, USDA, Washington, D.C., 20250

156. Ogrosky, H. O. ELECTRONIC COMPUTERS JOIN SCS TEAM IN PLANNING FOR WATERSHED PROTECTION. SCS, USDA, Washington, D.C., 20250

157. Barnard, J. W. REVISED PROGRAMS SHOW EXPANDING ROLE OF DISTRICTS IN CONSERVATION. SCS, USDA, Washington, D.C., 20250

158. Davey, W. B. RICE IRRIGATION RESERVOIRS HELP MEET NEW WATER NEEDS AND AID ECONOMY. SCS, USDA, Little Rock, Ark., 77201

159. Cappleman, H. L. IS YOUR DAM A BARGAIN? SCS, USDA, Washington, D.C., 20250

160. Kelly, L. L. WATERSHED RESEARCH SEEKS WAYS TO IMPROVE PLANNING. SWCRD, ARS, USDA, Beltsville, Md., 20705

161. Larsen, C. W. CONSERVATION SAVES FARMERS' WATER IN SOUTHERN UTAH DROUGHT COUNTIES SCS, USDA, Richfield, Utah. 84701

162. Grizzell, R. A., Jr. MINNOW FARMING EXPANDS AS LAND USE IN ARKANSAS. SCS, USDA, Little Rock, Ark., 77201

163. Cross, J. M. LARGE WATERSHED DAM TO PROVIDE RECREATION AREA. SCS, USDA, Alexandria, La., 71303

164. Phillips, B. "STEP DAM" BUILDS SELF AND STOPS GULLY WITH SEDIMENT. Beaumont Daily Gazette, Beaumont, Calif., 92223

165. Despain, D. W. TREES AGAINST THE WIND. SCS, USDA, Cody, Wyo., 82414

166. Kemmerer, H. R., and Butler, J. D. THE EFFECT OF SEEDING RATES, FERTILITY AND WEED CONTROL ON THE SPRING ESTABLISHMENT OF SEVERAL LAWN GRASSES. Proc. Amer. Soc. Hort. Sci. 85: 599-604. 1964.

In replicated plots of four bluegrass varieties, improved coverage resulted from increasing rates of seeding. The seeding rates used ranged from 4 to 120 lb./A. The experimental plots were sown in May, and coverage records were taken approximately 5 months later.

DMA, a post-emergence weed control chemical, applied in early August, resulted in a better bluegrass coverage than the use of a vertical cut mower. This in turn, gave better coverage than the check, which received no mowing or DMA. No single variety of bluegrass was significantly superior in preventing the development of weedy summer grasses. Fertilizer was incorporated into the soil of all plots just prior to seeding. Use of additional fertilizer at the time of seeding, and again in July, did not increase bluegrass coverage or reduce the prevalence of weedy grasses.

U. Ill., Urbana, Ill., 61803

167. Dunham, R. S. HERBICIDE MANUAL FOR NONCROPLAND WEEDS. U.S. Dept. Agr., Agr. Res. Serv. Agr. Hbk. 269, 90 pp. 1964.

A detailed review of the literature was given on herbicides for noncropland weeds.

ARS, USDA, Inform. Div., FCB, Hyattsville, Md., 20781

See Also 93, 110, 170, 175, 283.

168. Brawand, H. CROP RESIDUE EFFECT ON SOIL PROPERTIES AND SOIL MOISTURE CONSERVATION IN THE BLACKLANDS. Hoblitzelle Agr. Lab. B. 20, 27 pp. 1964.

The effects that annual applications of crop residues to the soil surface had on soil moisture conservation and utilization and on associated soil properties were determined.

Residue levels of 3,000, 6,000, and 9,000 lb./A. were compared with bare plots under field conditions of continuous cropping and fallowing. Fine- to medium-textured sundangrass hay was used as the residue, and none of the plots was cultivated during the progress of the experiment.

Water runoff from the plots was precluded by 5-inch metal rims to assure that equal quantities of water would be received by all plots. Differential evaporational water loss was assessed indirectly through regular measurements of the available soil moisture reserve. Differences between bare soil and residue treatments were most apparent in the soil surface layer, or the 0- to 1-inch depth.

The check plots produced an average 382 grams of aboveground dry matter, while the residue-covered plots produced an average 448 grams per season. This difference, amounting to 17.3 percent, was highly significant.

The surface residue plots averaged 5.06 inches of available water while the check plots averaged 4.68 inches of available water.

Aggregate stability was substantially higher in soil under residues than in checks. This was true for both the cropped and uncropped treatments.

The bare plots averaged 0.208 percent total soil nitrogen, while the mean of the surface residue treatments was 0.231 percent. This difference was highly significant. Total soil nitrogen was also highest at the higher residue levels.

The mean soil bulk density in residue plots was 0.764 grams per cubic centimeter for the 0- to 1-inch soil depth, and 0.826 in bare soil. The three residue levels of 3,000, 6,000, and 9,000 lb./A. failed to produce a significant difference. But bulk density in the cropped series exceeded that of the uncropped plots.

A modest improvement in soil structure, as indicated by aggregate stability and changes in bulk density, resulted in an impressive quantitative increase in water percolation, which averaged 11.9 liters of water per 3 hours for bare soil samples and 42.6 liters for residue treatments. Water percolation was more rapid in uncropped than in cropped soil.

Significant changes in the moisture content at soil saturation, field capacity, and wilting percentage indicated that application of crop residues increased the total pore space of the soil, and also increased the ratio of large pores to small pores in the soil.

Hoblizelle Agr. Lab., Tex. Res. Found., Renner, Tex., 75079

169. Yegorov, V. Y., and Lykov, A. M. CHANGES IN ORGANIC MATTER IN SOD-PODZOLIC SOIL AFTER FIFTY YEARS OF CULTIVATION. Soviet Soil Sci. 10: 943-951. Oct. 1963.

The balance of organic matter and nitrogen and their dynamics in the annual and longer cycles were determined, to find the values of the possible parameters of the qualitative changes in the nature of humus as a function of the prolonged, systematic use of fertilizers, crop rotation, and a single-crop system. The authors concluded that:

1. When field crops were grown on soils of the podzolic group without the use of organic fertilizers there was a loss of humus after 50 years, even under crop rotation with clover.
2. The prolonged systematic use of fertilizers, primarily manure, reduced the losses of humus and nitrogen considerably in soil under crop rotation and provided for a continuous increase of their content in soil under continuous rye. In this case, the content of humic acids increased, the ratio of humic to fulvic acids widened, and the content of the most mobile fraction of organic matter decreased.
3. The liming of soil widened the ratio of the C of humic acids to the C of fulvic acids even more and increased the content of humins in the composition of soil humus.
4. Prolonged soil cultivation with manure and mineral fertilizers changed the state of the nitrogen resources of the soil. The content of mineral and readily hydrolyzable nitrogen increased, but the major amounts of nitrogen accumulated in the soil as a result of the increased content of not readily hydrolyzable and of non-hydrolyzable nitrogen-containing organic compounds.

Scripta Technica Inc., 1000 Vermont Ave., N.W., Washington, D.C., 20005

Tillage

See Also 92, 169, 264, 285, 290.

170. Luebs, R. E., and Laag, A. E. TILLAGE AND NITROGEN FOR DRYLAND GRAIN...IN A WINTER RAINFALL CLIMATE. Calif. Agr. Expt. Sta. B. 805, 34 pp. 1964.

Experiments were conducted in southern California over a 15-year period to evaluate tillage and nitrogen fertility in dryland grain production.

During a period of less than 10 inches annual rainfall, tillage methods had little or no effect on grain yield in 3 of 4 years on an Arlington sandy loam. Moldboard plowing out-yielded chiseling and subtilling by nearly 500 lb./grain/A. in 1 year. Fall or winter fallow tillage was frequently superior to spring tillage.

With annual average rainfall of 13 to 14 inches, moldboard plowing averaged 400 and 500 lb./A. more grain than did disking or subtilling, respectively, on Ramona and Placentia sandy loams. Yields with plowing were also significantly greater when 30 lb. N/A. were applied. Average yield increases from nitrogen were larger on disked and subtilled plots.

Fallow tillage had little or no effect on grain yield where production was low (average of 1,000 lb./A.) on an eroded Placentia sandy loam. Fall chiseling resulted in significant yield increases over midwinter disking on this soil.

Fallow tillage methods—moldboard plowing, disking, and subtilling—usually had little effect on the test weight of grain.

Higher crude protein content of grain was obtained with moldboard plowing. Lowest protein levels were obtained when chiseling, rodweeding, or subtilling were the primary fallow tillage methods.

On Ramona sandy loam soil with 15-inch average annual rainfall, straw production with plowing was 500 and 600 lb./A. greater than with disking and subtilling.

Forage production of volunteer barley was significantly greater on plowed than on disked or subtilled plots 2 years after tillage operations were performed.

Soil nitrate accumulation over the fallow period was greatest with moldboard plowing. Increases up to 80 percent over subtilling and disking were determined in some years.

Six months after tillage, 60 percent of the crop residue remained on the soil surface with subsurface tillage (stubble mulch). Residue remaining on plowed, chiseled, and disked plots amounted to 8, 38, and 46 percent, respectively.

On low nitrogen soils, the practice of fallowing frequently did not insure adequate available nitrogen for dryland grain even under very limited rainfall.

Yield decreases with the application of nitrogen occurred in a few experiments.

Where nitrogen was needed, 30 to 40 lb./A. (applied before planting) were optimum for dryland grain after fallow.

Applied nitrogen usually increased the crude protein content of grain, but soil type and growing season were modifying factors. Nitrogen reduced test weight in a few instances.

Consistent and frequently large increases in straw yield were obtained from applying 30 to 40 pounds of nitrogen.

Over an 11-year period, 30 pounds of nitrogen usually produced higher grain yields than a purple vetch cover crop between barley crops.

Tables.

Calif. Agr. Expt. Sta., U. Calif., Riverside, Calif., 92502

171. Beale, O. W., and Langdale, G. W. THE COMPATABILITY OF CORN AND COASTAL BERMUDAGRASS AS AFFECTED BY TILLAGE METHODS. J. Soil and Water Conserv. 19(6): 238-240. 1964.

The simultaneous production of corn and Coastal bermudagrass on the same area under a broad range of tillage methods indicated that these crops were compatible. Differences between yields of corn produced with minimum tillage methods (lister-plant and rip-plant) and yields under conventional turnplow tillage were insignificant. About one-third of the surface soil was disturbed by lister planting, and one-half by rip planting. All of the surface soil was tilled under turnplow tillage.

Corn yields and the nitrogen contents of corn leaves indicated that the supply of nitrogen was not critical for corn growth and was not limited by grass usage. Moisture contents of the turnplow, lister-plant, and rip-plant plots were not markedly different during the corn growing season.

Corn stands surviving under the different tillage methods were similar. Lodging of the turnplow-tilled corn was significantly greater than that of the lister-plant or rip-plant-tilled corn.

Grass yields after corn harvest from the rip- and lister-plant areas were significantly larger than those from the turnplow-tilled area; grass stand retention followed a similar pattern.

SWCRD, ARS, USDA, Florence, S.C., 29501

Fertility Requirements for Conservation Farming

See Also 34, 37, 38, 39, 70, 72, 73, 80, 87, 89, 90, 94, 99, 104, 107, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 150, 166, 169, 170, 230, 233, 234, 239, 251, 252, 270, 285, 290, 292, 293, 307, 339, 346, 367, 370.

172. Bowling, J. D., and Wilson, D. EFFECT OF METHODS AND RATES OF FERTILIZER APPLICATION ON GROWTH AND DEVELOPMENT OF MARYLAND TOBACCO. Md. Agr. Expt. Sta. B. A-135, 26 pp. 1964.

Field-plot tests were conducted for 3 years on a representative tobacco soil in southern Maryland, to determine the relative merits of methods of fertilizer application used by tobacco growers in the area. The experiment included six methods of application at three rates of fertilizer. The methods were evaluated on the basis of return per acre. Other observations which might prove useful in the selection of a method to meet specific conditions were also included.

For the period of the test, rate means comprising all placement methods showed that each 800-pound increment of fertilizer significantly increased yield and value per acre and concentration of nitrate nitrogen in the plant, and decreased duration of burn in the leaf. Only the first increment (800-1600 lb./A.) significantly improved quality of the leaf and hastened flowering in the plant. Tobacco receiving all or part of the fertilizer under the row (M3 and, to a lesser degree, M5 and M6) seemed inclined to show significance with each increase in fertilizer, whereas the broadcast placements (M1 and M2) and the sidedress placement (M4) seemed more inclined to show a significant increase with the first increment only. With M2 and M6 quality of the leaf and with M4 concentration of nitrates in the plant showed no response to fertilizer. Plant mortality showed a response to fertilizer with only M3 and M6, and flowering did not respond to fertilizer under any of the methods. The control M3 was characterized by high plant mortality at the high fertilizer level and M4 by low concentration of nitrates in the plant rather generally at all levels. However, in neither case was there evidence of a significant resultant effect on yield or value per acre.

Placement means for the period of the experiment indicated that under specific conditions some methods were significantly (0.05) superior to others. At the lower rates of fertilizer, the sidedress placement (M4) was the only method that resulted in a significantly longer duration of leaf burn and a significantly higher yield and value per acre than that for the control (M3). Under the conditions of the test and on the basis of return per acre, there appeared to be no statistical evidence to support the recommendation of one method in preference to all others.

U. Md., Agr. Expt. Sta., College Park, Md., 20742

173. Lingle, J. C., and Wight, J. R. FERTILIZER EXPERIMENTS WITH CANTALOUPES. Calif. Agr. Expt. Sta. B. 807, 21 pp. 1964.

PMR 45 cantaloupes were grown at Davis, Calif., with different rates and combinations of N, P, and K fertilization.

Canteloupes were responsive to good fertilizer management. Responses to N in applications up to 120 lb./A. may be expected.

Yield responses to P were large, especially in terms of earlier maturity of the crop. The quantities of P needed depend on the soil, the season, and the method of application. Crownset fruit matured 7 days earlier in some experiments receiving P fertilization than in others receiving no P. The comparison of band versus broadcast application of P demonstrated that band application near the seed at or before planting was essential to be effective.

Possibilities of using leaf analysis as a guide to fertilization were explored. Either whole leaves or petioles may be used, but the different tissues have different critical levels. The most favorable time for tissue analysis was found to be at thinning, or when the plants have six to eight true leaves. If the NO_3-N level is less than 7,500 p.p.m. in the petioles or 5,000 p.p.m. in the whole leaves at thinning, the crop probably needs additional N for maximum yields.

All observations of several quality aspects indicated that maximum quality of fruit was associated with maximum yields. Heavy N applications did not reduce the appearance of quality of the fruit in terms of green sutures, netting, soft fruit, or sugar content. Some of these quality characteristics were lower on fruit harvested from plots deficient in N.

Heavier P applications should be made in years when prices are high early in the season; when a relatively stable price structure is expected, heavy N applications should be favored.

Irrigation practice affected fertilization management. Response to heavy fertilization was dependent on adequate but not excessive irrigation.

Tables, charts, and graphs.

Calif. Agr. Expt. Sta., U. Calif., Davis, Calif., 95616

174. Caro-Costas, R., and Vicente-Chandler, J. RESPONSE TO FERTILIZATION OF STRIP-CULTIVATED PLANTAINS GROWING ON A STEEP LATOSOL IN THE HUMID MOUNTAIN REGION OF PUERTO RICO. J. Agr. U. Puerto Rico 48(4): 312-317. 1964.

The effects of nitrogen, phosphorus, potassium, and magnesium fertilization on yields and foliar composition of strip-cultivated plantains growing on steep Cialitos clay, a typical latosol of the Humid Mountain Region of Puerto Rico, were determined.

Yields of plantains were sharply increased by the application of either 200 pounds of nitrogen, 200 pounds of phosphoric acid, 400 pounds of potassium, or 100 pounds of magnesium per acre, when all other nutrients were present in abundance.

Foliar composition of the plantains at 7 months indicated their yield response to the various nutrients. Approximate percentage leaf contents indicating a deficiency and a sufficiency, respectively, of the various nutrients when all other nutrients were provided in abundance were as follows: Nitrogen 3.5 and 4.0; phosphorus 0.15 and 0.21; potassium 2.3 and 3.3 percent; and magnesium 0.15 and 0.31.

Agr. Expt. Sta., U. Puerto Rico, Rio Piedras, Puerto Rico, 00928

175. Beaty, E. R., Clements, R. G., and Powell, J. D. EFFECTS OF FERTILIZING PENSACOLA BAHIAGRASS WITH NITROGEN. J. Soil and Water Conserv. 19(5): 194-195. 1964.

The amount of herbage produced by an established stand of Pensacola bahiagrass increased significantly as the rate of nitrogen fertilization increased. Ignition loss, organic matter content, and cation-exchange capacity of the Eustis loamy sand were not affected by the rate of nitrogen fertilization of bahiagrass. Cation-exchange capacity of the soil was 81.4 percent higher with the organic matter present than with the organic matter removed.

Branch Expt. Sta., U. Ga., Athens, Ga., 30601

176. Terman, G. L., and Hunt, C. M. VOLATILIZATION LOSSES OF NITROGEN FROM SURFACE-APPLIED FERTILIZERS, AS MEASURED BY CROP RESPONSE. Soil Sci. Soc. Amer. Proc. 28(5): 667-672. 1964.

Yields and uptake of N by corn forage grown in pot experiments with N fertilizers mixed with and surface-applied to moist soils a week prior to planting were determined.

Losses of N were low with mixed placement. High losses of N, presumably as NH occurred from granular urea surface-applied to Hartsells find sandy loam limed to pH 6.2 and 7.5 and to Webster silty clay loam (pH 8.2). Losses were reduced by coating urea with S or by including phosphate in the granules as urea ammonium phosphate. Severe losses of N also occurred with surface-applied ammonium sulfate and diammonium phosphate, especially from the naturally calcareous Webster soil.

Maximum recoveries from soils of pH 6.2 to 8.2 were obtained from monoammonium phosphate, ammonium nitrate, ammonium phosphate nitrate, and ammonium polyphosphate.

Differences in losses of N as NH among N fertilizers were explained largely in terms of urea hydrolysis or the reaction of certain acid radicals of ammonium salts with calcium compounds in soil.

Res. Branch, TVA, Wilson Dam, Ala., 35661

177. Stanford, G., and Ayres, A. S. THE INTERNAL NITROGEN REQUIREMENT OF SUGARCANE. Soil Sci. 98(5): 338-344. 1964.

Variety X amounts-of-nitrogen factorial experiments were conducted in six fields on five Hawaiian sugarcane plantations. The dependent variables, "yields of dry matter" and "total nitrogen uptake" at crop ages of 20 to 24 months, were related to the amount of N applied. The amount of N taken up by sugarcane at near-maximum yield was approximately 4 pounds per ton of dry matter. Since this value ranged narrowly for different varieties and locations, it was concluded that internal requirement was independent of variety and location.

Hawaiian Sugar Planter Assoc., Honolulu, Hawaii, 96814

178. Finn, B. J., and Mack, A. R. DIFFERENTIAL RESPONSE OF ORCHARDGRASS VARIETIES (DACTYLIS GLOMERATA L.) TO NITROGEN AND PHOSPHORUS UNDER CONTROLLED SOIL TEMPERATURE AND MOISTURE CONDITIONS. Soil Sci. Soc. Amer. Proc. 28(6): 782-785. 1964.

In a greenhouse experiment, the growth and nutrient uptake of four varieties of orchardgrass were differentially affected by soil temperature and moisture. The yield of tops, for all varieties, was increased by a rise in soil temperature from 10° C. to 20° C. and by a rise in soil moisture from 25 percent to 75 percent of the available soil moisture capacity. The yield of roots was increased by a decrease in soil temperature from 20° C. to 10° C. when associated with the high soil moisture level. Under warm soil conditions, a rise in available soil moisture generally produced similar increases in top yields for all varieties. Under cool soil temperature, a rise in soil moisture increased top yields in the following order: Frode>Rideau S-143=Chinook. Under the same moisture and temperature condition, root yields were in the order of Frode>Chinook= >Rideau.

The influence of N fertilization on herbage yield and on N uptake was only slightly affected by soil temperature and moisture. A rise in soil temperature and soil moisture increased the uptake of soil P and decreased the effect of applied P on yield and P uptake. Under P fertilization the uptake of P by the varieties differed with environment: the order was S-143>Frode=Rideau>Chinook at 20° C. and 75 percent moisture, and Frode=Rideau>S-143=Chinook at 10° C. and 25 percent moisture.

Soil Res. Inst., Res. Br., Canada Dept. Agr., Ottawa, Ontario, Canada.

179. Reith, J. W. S. SEED TIME AND LATE NITROGEN FOR BARLEY. Scottish Agr. 43: 214-216. Spring 1964.

There was no evidence from this experiment that the efficiency of nitrogen could be increased by either late or split dressings. The considerable variation between experiments in the time of application which produced the highest yield could not be attributed to any one factor or set of conditions.

Although high rainfall during the weeks immediately after seeding might be one of the factors favoring "medium" or 'late" dressings, there was not sufficient evidence for any definite statement. In general, applying all the nitrogen some 8 to 10 weeks after seeding was undesirable because of the risk of delaying the ripening of a proportion of the crop. Otherwise, nitrogen can be applied at any convenient time during the early development of the crop. Normally the most economical application will be at seeding time when all three nutrients (nitrogen, phosphate, and potash) can be combine-drilled or broadcast in the form of a compound fertilizer.

There was no advantage in adopting a policy of applying only half of the required amount of nitrogen at seed time and half as a later top dressing because this only occasionally produced better yields. A top dressing can, however, be effectively applied to any field where early growth indicates that the seed time dressing was inadequate, and such nitrogen dressings will normally have a similar effect on yield as an equivalent amount applied at seed time.

Macaulay Inst. Soil Res., Craigiebukler, Aberdeen, Scotland.

U.S. Department of Agriculture and Tennessee Valley Authority. SUPERPHOSPHATE: ITS HISTORY, CHEMISTRY, AND MANUFACTURE. U.S. Dept. Agr. & Tenn. Valley Authority Unnumbered Rpt. 349 pp. Dec. 1964.

Conferees at an annual U.S. Department of Agriculture-Tennessee Valley Authority fertilizer research program review agreed that a compilation of current information on superphosphate manufacture could substantially benefit technology in this segment of the fertilizer industry. This book contains information on the following: History of superphosphates; current industry practices and how they came about; and the chemistry of manufacture.

The following chapters were given:

180. Hardesty, J. O. INTRODUCTION, SCOPE, AND DEFINITIONS.

181. Jacob, K. D. PREDECESSORS OF SUPERPHOSPHATE.

182. Jacob, K. D. HISTORY AND STATUS OF THE SUPERPHOSPHATE INDUSTRY.

183. Hill, W. L. RAW MATERIALS.

184. Hatfield, J. D. NORMAL SUPERPHOSPHATE: CHEMISTRY.

185. Slack, A. V. NORMAL SUPERPHOSPHATE: MANUFACTURING EQUIPMENT.

186. Slack, A. V., and Rindt, D. W. NORMAL SUPERPHOSPHATE: MANUFACTURING OPERATIONS.

187. Hatfield, J. D. CONCENTRATED SUPERPHOSPHATE: CHEMISTRY.

188. Hill, W. L., and Jackson, W. A. CONCENTRATED SUPERPHOSPHATE: MANUFACTURE.

189. Fox, E. J. FLUORINE: EMISSION AND RECOVERY.

190. Hardesty, J. O. GRANULATION.

191. Caro, J. H. CHARACTERIZATION OF SUPERPHOSPHATE.

192. Spencer, N. L. COST FACTORS IN THE PRODUCTION AND USE OF SUPERPHOSPHATE.

193. Slack, A. V. STATUS OF SUPERPHOSPHATE IN RELATION TO OTHER FERTILIZER PHOSPHATES.

Tables, graphs, photographs, and bibliographies.

ARS, USDA, Inform. Div., FCB, Hyattsville, Md., 20781

194. Power, J. F., Grunes, D. L., Reichman, G. A., and Willis, W. O. SOIL TEMPERATURE EFFECTS ON PHOSPHORUS AVAILABILITY. Agron. J. 56(6): 545-548. 1964.

The temperature at which Parshall soils receiving no fertilizer P were incubated had only minor effects on the solubility of P in $NaHCO_3$ or water. At high rates of P fertilization, soluble P concentrations were reduced by incubation temperatures in excess of 59° F. Cropping with barley reduced $NaHCO_3$-soluble P concentrations in comparision to those for uncropped incubated soils. This decrease was directly related to total P uptake by barley and was independent of temperature. The relation between the decrease in $NaHCO_3$-P solubility and P uptake was linear, with a slope of 0.65 for P-fertilized soil, and 0.35 for unphosphated soil.

Both $NaHCO_3$- soluble P and water-soluble P concentrations in the incubated soils were related to dry weights and total P uptake by barley. In each instance, a separate curve was obtained for each soil temperature. Plant growth began to level off at 16 p.p.m. $NaHCO_3$-soluble P at soil temperatures of 59° F. or below. At higher soil temperatures; however, this relation became more linear. Consequently, it appears that growth at high soil temperatures is much more dependent upon the soluble P supply than at cooler temperatures.

The degree to which the genetic growth potential was achieved at a given temperature was regulated by P solubility. However, P solubility may also be temperature-dependent. Consequently, soil temperature may influence plant growth in the following two ways: (1) Effects on the plant per se; and (2) effects on P solubility. By both means, soil temperature may have a measurable influence on the results of a soil testing program.

SWCRD, ARS, USDA, Mandan, N. Dak., 58554

195. Thomas, J. R. AVAILABILITY OF RESIDUAL PHOSPHORUS AS MEASURED BY ALFALFA YIELDS, PHOSPHORUS UPTAKE, AND SOIL ANALYSIS. Soil Sci. 98(2): 78-84. 1964.

The availability fo residual P in a calcareous soil was measured by plant uptake of P and by P solubility in $NaHCO_3$ and NH_4F.

Recovery of fertilizer P during a 5-year period was very low. Maximum recovery was 27.7 percent of the 26.2-pound P addition. Manure reduced the uptake of fertilizer P.

Uptake of P by plants was significantly related to P extractable in $NaHCO_3$ and dilute acid-NH_4F.

Amounts of extractable and total P in the soil after 5 years of cropping were significantly correlated to prior fertilizer additions.

The changing relationship between $NaHCO_3$ and dilute acid-NH_4F-extractable P with cropping may reflect a conversion of P forms. It was suggested that $NaHCO_3$-soluble P is more readily absorbed by plants than are dilute acid-NH_4F-soluble P forms, and that some fraction of the dilute acid-NH_4F-soluble P replenishes the supply of $NaHCO_3$-extractable P.

SWCRD, ARS, USDA, Weslaco, Tex., 78596

196. Hodges, E. M., Kirk, W. G., Peacock, F. M., Jones, D. W., Davis, G. K., and Neller, J. R. FORAGE AND ANIMAL RESPONSE TO DIFFERENT PHOSPHATIC FERTILIZERS ON PANGOLAGRASS PASTURES. Fla. Agr. Expt. Sta. B. 686, 28 pp. 1964.

Results applicable to Immokalee and other acid flatwoods soils in central and south Florida were reported. The phosphorus supply in these virgin soils is inadequate for optimum growth of pangolagrass, and phosphorus content of herbage produced is marginal for cattle nutrition.

All forms of phosphate tested increased pangolagrass growth and raised herbage phosphorus content to levels considered adequate for animal nutrition. Beef cows remained in excellent flesh and at a moderate production level while obtaining all energy, protein, calcium, and phosphorus from pangolagrass pasture.

Superphosphate and triple superphosphate were the most widely useful sources of phosphorus for pangolagrass pastures by virture of their productivity, favorable cost, and handling factors. Need for a fertilizer source of sulfur frequently enhanced the value of superphosphate.

Annual application rates of 25 to 50 lb./A. available P_2O_5 as superphosphate, triple superphosphate, or basic slag supported vigorous pangolagrass growth, with no excessive accumulation of soil phosphorus. High levels of herbage and soil phosphorus obtained with rock phosphate did not give proportionately higher forage or animal production.

Application of lime produced small increases in pangolagrass forage and beef production; liming to at least ph 5.5 was recommended for all improved grass pastures. Added increments of nitrogen increased forage and beef production.

U. Fla., Agr. Expt. Sta., Gainesville, Fla., 32603

197. Laughlin, W. M., and Restad, S. H. EFFECT OF POTASSIUM RATE AND SOURCE ON YIELD AND COMPOSITION OF BROMEGRASS IN ALASKA. Agron. J. 56(5): 484-487. 1964.

Four K rates using sulfate and muriate of K were applied each of 3 years to an established bromegrass stand which previously gave visible response to K application. Dry-matter yields and N, P, K, and Mg contents of the forage were determined each year. Ca content was determined in the 1962 forage. The uptake of these elements, Ca/Mg ratio, and sum of K, Mg, and Ca cations were determined.

K application significantly increased dry-matter yields. Increments of K exceeding 33 pounds K per acre produced relatively small yield increases.

Each K increment increased the K content, tended to increase the sum of the K, Mg, and Ca cations, and tended to decrease the Ca content and the Ca/Mg ratio. The decrease in N content with increasing K was generally not significant.

P and Mg contents were independent of K application.

The Mg content was very high. This high value coupled with a relatively low Ca content produced a very low Ca/Mg ratio.

Second clipping forage each year contained more P and Mg than did the first clipping.

Sulfate and muriate of potash were generally equally effective as a K source for bromegrass.

Alaska Agr. Expt. Sta., Palmer, Alaska, 99735

198. Xydias, G. K., and **Leaf,** A. L. WEEVIL INFESTATION IN RELATION TO FERTILIZATION OF WHITE PINE. Forest Sci. 10(4): 428-431. 1964.

Nitrogen, phosphorus, and potassium fertilizer treatments in a Pinus strobus L. plantation were related to tree growth and incidence of white pine weevil damage. In this plantation—growing on deep, coarse, sandy, potash-deficient soil—potassium significantly increased tree growth and weevil damage while nitrogen caused decreases. A nitrogen-potassium interaction was indicated. Fertilizing of white pine involved consideration of possible benefits in wood production vs possible damage by weevils.

State U. Col Forestry, Syracuse U., Syracuse, N.Y., 13210

199. Hallock, D. L. RESPONSE OF SOYBEANS TO GYPSUM, LIME AND FERTILIZER ON THREE SOILS IN SOUTHWESTERN VIRGINIA. Va. Agr. Expt. Sta. Res. Rpt. 89, 17 pp. 1964.

Experiments with soybeans which included four rates of gypsum, three rates of fertilization, and two rates of lime were carried out on Craven fine sandy loam in 1959, Bladen fine sandy loam in 1960, and Sassafras loamy fine sand in 1961. A summary of the results were:

1. Gypsum did not increase or decrease yield or any other crop variable measured.
2. Lime increased yields at both the Craven and Sassafras sites.
3. Lime increased seed size at the Craven site.
4. Lime increased the expression of purple seed stain disease in Hood soybeans growth in 1959 on Craven soil.
5. Lime increased the content of protein in seeds grown on Craven soil.
6. Lime reduced the percentage of oil in seeds grown on Sassafras soil.
7. Fertilizer reduced the percentage of protein in seeds grown on both Craven and Sassafras soils.
8. There was an interaction in the effect of lime and fertilizer on the percentage of protein in seeds grown on Sassafras soil.
9. There were no satistically significant differences among the plant data recorded for the Bladen site.
10. Soybeans grown on well-limed southeastern Virginia soils, which by rapid chemical tests are still low in available calcium, generally did not respond to gypsum fertilization.

Tables.

Agr. Expt. Sta., Va. Polytech. Inst., Blacksburg, Va., 24061

Hawaii Farm Sci. 13(3): 1-12. 1964.

This issue of Hawaii Farm Science was devoted to liming of Hawaii soils. The current status of lime use and the outstanding yield benefits derived from lime treatment were discussed. Also described were some of the current theories and reasons why lime behaves as it does.

The following articles were given:

200. Younge, O. R. SOME NOTES ON SOIL LIMING.

201. Younge, O. R., and Plucknett, D. L. LIME, A NEGLECTED MATERIAL FOR HIGH YIELDS ON HAWAIIAN SOILS.

202. Matsusaka, Y., and Sherman, G. D. LIME REQUIREMENTS OF HAWAIIAN SOILS.

203. Younge, O. R., and Plucknett, D. L. LIMING MATERIALS.

204. Sherman, G. D., Dias, I. P. S., and Monteith, N. H. CALCIUM SILICATE, A NEW LIMING MATERIAL.

205. Fox, R. L., and Plucknett, D. L. OVERLIMING HAWAIIAN SOILS CREATES PROBLEMS.

206. Mikami, D. T., and Kimura, H. S. SPECIAL FEATURES OF LIME-DEFICIENT TROPICAL SOILS.

In addition there was a listing of the University publication on liming Hawaiian soils and graphs indicating lime requirements of Hawaiian soils.

U. Hawaii, Col. Trop. Agr., Hawaii Agr. Expt. Sta., Honolulu, Hawaii, 96814

207. Whittaker, C. W., and Chichilo, P. INTERPRETATION OF SIEVE ANALYSES OF AGRICULTURAL LIMESTONES AND SUGGESTED PARTICLE SIZE SPECIFICATIONS. Agron. J. 56(6): 561-565. 1964.

Detailed sieve analyses were made of 193 agricultural limestone samples representative of production in 35 states. Considerable variation in fineness existed among the limestones of various regions, but the greater proportion of United States agricultural limestones fell into the "ground" or "meal" grades having 20 to 25 percent passing a No. 100 sieve and 80 to 95 percent passing the No. 8.

The log normal plot of sieve opening diameters against cumulative percent passing, and the simple statistics of the quartiles, median and sorting coefficient, were more useful than other systems tested in the interpretation and comparision of sieve analyses. Detailed sieve analyses yielded a log normal plot consisting of a relatively straight middle portion with increased curvature at the ends. The position on the chart, the slope, and the curvature were highly descriptive of the distribution plotted. Although such plots were frequently signficantly curvilinear, a straight-line log normal plot of percentages passing two well-spaced sieves could often serve as a useful and practical guide to the approximate nature of a given distribution. The median was the most important single statistic of a distribution because it located an "average" particle size.

It was suggested that agricultural limestone specifications require that 50 percent pass a median sieve appropriate to the fineness desired and that, to eliminate gross oversize, 95 percent pass some coarser sieve. Where absence of the very fine particles is a possibility, a third sieve should be added in the fine range.

SWCRD, ARS, USDA, Beltsville, Md., 20705

208. Breland, H. L. LIME IN FLORIDA AGRICULTURE. Fla. Agr. Expt. Sta. C. S-155, 19 pp. 1964.

A report was given on the need and use of lime for Florida Agriculture. The following table lists the calcium carbonate equivalent for some of the liming materials used in the State.

TABLE — Liming Materials, their Chemical Formulas and Calcium Carbonate Equivalents.

Materials	General Formula	C.C.E.*
Limestone	$CaCO_3$	100
Dolomite	$CaCo_3.MgCO_3$	92
Burned lime	CaO	56
Hydrated lime	$Ca(OH)_2$	74
Oyster shells	$CaCO_3$	105
Slags	$(CaO)_5.\ P_2O_5.\ SiO_2$	125-143
Marl	$CaCO_3.\ MgCO_3$	115-184
Gypsum	$CaSO_4$	0

* The pounds of the material being used that are required to have the same neutralizing value as 100 pounds of pure calcium carbonate.

U. Fla., Agr. Expt. Sta., Gainesville, Fla., 32603

209. Hart, S. A. MANURE MANAGEMENT. Calif. Agr. 18(12): 5-7. 1964.

Today's specialization with development of large-scale "factory farms," including drylot dairies, beef feedlots, and chicken ranches, plus the spread of urbanization to house an increasing population, have created new problems for both farmers and city dwellers. Disposal of livestock manure, the greatest of the problems with agricultural wastes, was discussed.

Different methods of collection, processing, storage, and utilization or disposal were discussed.

Research on better manure utilization for crops is now underway by agronomists, olericulturists, and other specialists. Scientists are now beginning to plan their research in terms of what crops and in what manner the manure can best be utilized—since most of it must be desposed of upon cropland.

Some of the manure may have a use other than its return to the land for fertilization. Vitamins, hormones, and some drugs are recoverable from manure, but the method is not economical to date.

U. Calif., Davis, Calif., 95616

Salinity and Alkali Problems

See Also 33, 68, 82, 91, 100, 137, 138, 141, 154.

210. Lyles, L., and Fanning, C. D. EFFECTS OF PRESOAKING, MOISTURE TENSION, AND SOIL SALINITY ON THE EMERGENCE OF GRAIN SORGHUM. Agron. J. 56(5): 518-520. 1964.

The effects of presoaking, moisture tension, and soil salinity on emergence of RS610 grain sorghum were determined. Major interest was in obtaining seedling emergence in saline soil. Soaking increased emergence slightly (maximum 26 percent) where the moisture tension exceeded 0.33 atm. and salt concentration of the saturated soil extract did not exceed 10 mmhos./cm. Soaked seed emerged about 1 day before unsoaked seed at each salinity level.

Critical total soil moisture stress (moisture tension plus osmotic pressure of the soil solution) for the variety studied was approximately 8 atm. This explains the need for good moisture conditions for emergence in saline soil, because the moisture tension must be low to assure that the combined effect of osmotic pressure does not produce total soil moisture stresses exceeding the critical stress for emergence of the plant species in question.

SWCRD, ARS, USDA, Weslaco, Tex., 78596

211. Lunt, O. R., Kaempffe, C., and Youngner, V. B. TOLERANCE OF FIVE TURFGRASS SPECIES TO SOIL ALKALI. Agron. J. 56(5): 481-483. 1964.

The growth of Puccinellia distans, Seaside bentgrass, Alta fescue, Kentucky bluegrass, and common bermudagrass, as influenced by exchangeable sodium percentage in soils, was studied in both untreated and VAMA treated Yolo loam soil. The authors concluded that:

1. Puccinellia distans and Seaside bentgrass showed good ability to tolerate ESP in the range up to 26 to 28. Potentially they should be able to produce good turf on soils having ESP this high or higher. Since these grasses also have outstanding and good salinity tolerances, respectively, and good boron tolerance, they should be considered for use in extremely difficult areas. Alta fescue, Kentucky bluegrass, and common bermudagrass showed only slight growth reduction at ESP levels up to 11 or 12 but were reduced in growth by about 35 to 50 percent at ESP levels of 26 to 28.
2. In spite of growth reductions, good, dense turf was produced at the higher ESP treatments. Projecting these greenhouse data to possible performance under field conditions does not take into account the additional deterioration in soil structure under turfgrass which might develop from foot traffic.
3. Chemical analyses were also presented. The two most tolerant grasses showed either an ability to accumulate sodium or a low uptake of calcium plus magnesium. The growth of Puccinellia distans and Alta fescue was not affected by VAMA treatments while that of the other grasses was substantially improved.

U. Calif., Los Angeles, Calif., 90024.

212. Carter, D. L., and Myer, V. I. SOIL CHEMICAL AND PHYSICAL PROPERTIES ASSOCIATED WITH DEPRESSIONAL SALINE AND ADJACENT AREAS IN TWO GRAPEFRUIT GROVES. J. Rio Grande Valley Hort. Soc. 18: 51-59. 1964.

Some chemical and physical properties of saline, transitional, and unaffected soils in two grapefruit groves were studied in relation to tree growth, surface elevation, and depth to the water table.

The saline soils contained extremely high salt concentrations in the surface few inches, but salt concentration decreased sharply with depth. Transitional soils contained salt concentrations near the critical level for grapefruit trees. Unaffected soils were low in salt.

The saline soils contained mostly calcium, magnesium, and sodium chlorides. About two-thirds of the cations were Ca^{+++} and Mg^{++}, and the other one-third, Na^{+}. Cl^{-} composed over 90 percent of the soluble anions in saline soils, whereas only very small quantities of Cl^{-} were found in transitional and unaffected soils. HCO_3^{-} was the predominant anion in unaffected soils where total salt concentration was low.

Unaffected soils were higher in surface elevation than were saline soils. Transitional soils were a little higher than saline soils. The water table was always nearer the surface of saline, depressional locations than at the other locations sampled. Irrigation and heavy rainfall caused high water table conditions in depressional areas. During and following high water table periods, more salt accumulated in the low saline areas because of more evaporation.

Soluble salts accumulate in the surface few inches of soil where the water table is near enough to the soil surface to allow continuous upward water movement and evaporation. Such soils will not produce citrus without intensive management practices. Only soils with adequate drainage should be planted to citrus.

SWCRD, ARS, USDA, Kimberly, Idaho, 83341

213. Bernstein, L. SALT TOLERANCE OF PLANTS. U.S. Dept. Agr., Agr. Res. Serv., Agr. Inform. B. 283, 23 pp. 1964.

The electrical conductivity of the saturation extract of soils, a measure of total salinity, adequately describes the effective salt content of the soil for most crop situations. Since many fruit crops, trees, and shrubs are sensitive to chloride and sodium, the additional determination of these elements in the saturation extract is often advisable.

Analysis of plant samples is useful in detecting nutritional effects of salinity and in diagnosing toxic accumulations of chloride or sodium in fruit crops, trees, and shrubs.

The salt tolerance of plants varies widely, not only from crop to crop but in some cases even for a given crop, depending on its stage of growth. Salt-tolerance data are useful in diagnosing salt injury and in selecting tolerant crops for saline conditions.

Proper management practices, especially adequate irrigation and suitable planting techniques, can lessen the harmful effects of salinity. Improved yields will result from decreases in harmful salinity only if all other factors (fertility, insect and disease control, crop varieties, etc.) are adequate for higher yields.

Charts were given that showed the salt tolerance data for field crops, vegetable crops, and forage crops.

Tables, charts, and photographs.

ARS, USDA, Inform. Div., FCB, Hyattsville, Md., 20781

214. Kelley, W. P. MAINTENANCE OF PERMANENT IRRIGATION AGRICULTURE. Soil Sci. 98(2): 113-117. 1964.

The previous failure of crops on irrigated soils has been caused in most instances by excessive salts that accumulated as a result of a high water table. Some of the more important means by which this trend can be averted and the damage to crops corrected are: (1) The introduction of an effective drainage system; (2) the leaching out of the accumulated salts; and (3) the replacement of absorbed Na^+, wherever it occurs by Ca^{++}.

The development of a high water table should be interrupted before serious injury has been produced. A close watch should be kept on the rising water table, and wherever it has risen to within 10 to 15 feet of the surface, artificial drainage should be provided.

In most areas, the injurious effects of salt accumulation can be overcome, but the loss of crops, the expense of removing salts once accumulated, and of restoring conditions favorable for crop growth, are considerable.

Although the future development of water supplies for dry areas will continue to be largely an engineering problem, serious consideration should be given to the probable development of a high water table. This should be done at the outset of a given irrigation project, rather than be delayed until severe damage has been produced.

Serious injury may result from the use of saline irrigation water, and such injury is not necessarily related to a high water table. Unless the salinity of the water is high or Na salts greatly predominate, the application of the water in amounts sufficient to effect leaching will go far to prevent the accumulation of harmful amounts of salts.

Most of the areas where crops have already been affected with a high water table and salts can be reclaimed and made productive by methods now well established. In California, Arizona, and other western states, an aggregate of many thousand acres, once severely affected with a high water table and salts, have already been reclaimed and are now producing good yields of crops.

The maintenance of good crop production on irrigated soils (as well as other soils) also requires the upkeep of all the essential plant nutrients.

U. Calif., Berkeley, Calif., 94720

Cover Crops and Green Manure Crops

See 170, 242, 285.

Climatic Influences

See Also 6, 7, 9, 14, 17, 47, 53, 59, 66, 93, 119, 122, 145, 150, 161, 165, 170, 176, 178, 179, 194, 212, 242, 247, 272, 286, 290, 337.

215. Kost, W. E. WEATHER INDEXES: 1950-1963. Mich. Agr. Expt. Sta. Q. B. 47(1): 38-42. 1964.

Weather indexes provide a measure of variability in agricultural output due to the influences of weather. Their primary use is to adjust yields and production for weather influences. The adjusted data are better able to show the effects of the nonrandom elements being studied. They can also be used to show how much of the increase in output in recent years is due to weather and how much to technology.

The influence of weather is measured in each year as that year's actual yield as a percentage of the computed trend yield. This percentage can be expressed over time as in index. A weather index of 100 would indicate a year where the trend yield equaled the actual yield. This corresponds to "normal" or expected weather, a long-term average of weather conditions.

Tables.

Mich. State U., Agr. Expt. Sta., East Lansing, Mich., 48823

216. Kidd, W. J., Jr. PROBABLE RETURN PERIODS OF RAINSTORMS IN CENTRAL IDAHO. U.S. Forest Serv. Res. Note INT-28, 8 pp. 1964.

Analyses of data recorded for 229 rainstorms in the mountains of central Idaho yielded information from which "probable period of return" curves were developed for storms of varied volumes, durations, and intensities.

Although the probability curves are based on data for only 5 years (1959-63), they are being published now because this information is needed. More accurate results can be obtained only from analysis of long-term records of rainfall.

FS, USDA, Intermountain Forest & Range Expt. Sta., Odgen, Utah, 84403

217. Miller, J. F., Jr. TWO- TO TEN-DAY PRECIPITATION FOR RETURN PERIODS OF 2 TO 100 YEARS IN ALASKA. U.S. Dept. Comm. Weather Bur. Tech. Paper 52, 30 pp. $0.60. 1965.

Precipitation data for various hydrologic design problems involving areas up to 400 square miles and durations from 2 to 10 days were presented for Alaska. The data consist of generalized estimates of rainfall-frequency data for return periods of from 2 to 100 years.

Maps and graphs.

For sale, Supt. Doc., U.S. Govt. Printing Off., Washington, D.C., 20402

218. Comer, G. H., and Hamon, W. R. COMPUTER REDUCTION OF PRECIPITATION DATA. U.S. Dept. Agr., Agr. Res. Serv. ARS 41-89, 38 pp. 1964.

The tedious and repetitious calculations required in reducing raw precipitation data into quantities needed for analysis and reporting were performed by an IBM 1620 computer using the program presented. Input data for the program may be punched either manually or by an automatic chart reader.

Precise calculations were performed by the computer in determining values for the following three separate output sections: (1) Precipitation intensities and amounts of precipitation by intervals, storm, day, month, and year; (2) maximum intensities for various time periods; and (3) precipitation amounts for regular time periods. The last two sections could be bypassed if desired.

The output data were punched in cards of a form designed for reuse as "input" data to analysis and data handling programs. Each card was numbered and each type of output had a code unique to that group, so that all sorting, separation, and handling of the data could be done by machine.

Flow diagrams, program listings, and complete instructions for using the program were included.

SWCRD, ARS, USDA, PIS, Beltsville, Md., 20705

219. Rubin, J., and Steinhardt, R. SOIL WATER RELATIONS DURING RAIN INFILTRATION: III. WATER UPTAKE AT INCIPIENT PONDING. Soil Sci. Soc. Amer. Proc. 28(5): 614-619. 1964.

Rain-induced ponding onset was analyzed theoretically by using a diffusion-type equation of soil moisture flow and was investigated experimentally by employing laboratory columns of a sandy soil.

Equations for the lower and upper bounds of water uptakes at incipient ponding were derived. These expressions seemed to represent well the experimentally established relation between rain intensity (R) and cumulative rain uptake by a soil on the surface of which isolated puddles just started to form. In every case observed, such an uptake was significantly smaller than one of a flood-wetted column which reached an infiltration rate equal to R. On the other hand, at identical water entry fluxes, similar uptakes were exhibited by flooded columns and rain-wetted soil which had just become completely covered by a mantle of ponded rain-water.

U.S. Geol. Survey, Dept. Int., Menlo Park, Calif., 94028

220. Whitehead, H. C., and Feth, J. H. CHEMICAL COMPOSITION OF RAIN, DRY FALLOUT, AND BULK PRECIPITATION AT MENLO PARK, CALIFORNIA, 1957-1959. J. Geophysical Res. 69(16): 3319-3333. 1964.

Winter precipitation is defined as rain, dry fallout, and bulk precipitation—the last being a mixture of the other two. The division of winter precipitation into phases is based on collection procedures. Each phase shows distinctive characteristics of chemical composition. Rain displays the strong influence of the nearby Pacific Ocean and San Francisco Bay. Dry fallout, collected between rains, shows strong effects from locally derived materials in the atmosphere. Bulk precipitation shows, in chemical composition, the expected blending of the two environmental influences, and is about 4 to 10 times higher in mineral concentration than rainwater is. Bulk precipitation is considered the geochemically significant phase that should be used in studies relating contributions of atmospheric salts to surface and ground water supplies, to weathering, and to the nourishment of growing plants. Comparison with published data indicates that, wherever sampled, bulk precipitation contained more dissolved mineral content than rainwater did. Increasing attention should be given to minor constituents in precipitation, as well as to recognition of the several phases of precipitation.

Water Resource Div., U.S. Geol. Survey, Dept. Int., Menlo Park, Calif., 94028

221. Hershfield, D. M. ESTIMATING THE MAXIMUM 24-HOUR SNOWFALL. B. Internatl. Assoc. Sci. Hydrol. 9(4): 32-39. 1964.

The statistical analysis, which made use of some readily available snowfall data, resulted in a description in terms of a few parameters only. Besides providing an enveloping or probable maximum 24-hour snowfall for each of 200 stations in the United States, the parameters can be used to estimate the probability of an event of any given magnitude if an extreme-value distribution is assumed to be applicable.

Limitations of the data and procedure were discussed.

SWCRD, ARS, USDA, Beltsville, Md., 20705

222. Laflen, J. M. AN EVAPORATION RECORDER. J. Agr. Engin. Res. 9(3): 294-297. 1964.

A recorder was described and illustrated to record evaporation from a U.S. Weather Bureau evaporation pan.

There are two possibilities for indicating false evaporation rates, but these can be compensated for or calculated.

One error occurs when evaporation ceases and precipitation begins, and when precipitation ceases and evaporation begins. Frequently this error occurs twice on the same chart. If evaporation is being recorded and precipitation begins, the maximum weight difference required to record must be shifted from the float to the counterbalance. The water level must rise enough for the counterbalance to become 50 g. heavier than the float, or the float about 100 g. lighter. From the values given earlier, the water level would need to rise > 0.02 in. When evaporation follows precipitation, the water level must drop > 0.02 in. before evaporation is recorded.

The second error is that of expansion and contraction of the water because of water temperature changes, causing considerable errors in evaporation rates indicated by the recorder during certain times of the day. Daily measurements of evaporation are also in error if water temperatures vary greatly.

SWCRD, ARS, USDA, Baton Rouge, La., 70801

223. Becker, C. F., and Alyea, J. D. TEMPERATURE PROBABILITIES IN WYOMING. Wyo. Agr. Expt. Sta. B. 415, 156 pp. 1964.

224. Becker, C. F., and Alyea, J. D. PRECIPITATION PROBABILITIES IN WYOMING. Wyo. Agr. Expt. Sta. B. 416, 97 pp. 1964.

These two publications give the temperature and precipitation possibilities for various sections of Wyoming.

Tables, charts, and maps.

U. Wyo., Agr. Expt. Sta., Laramie, Wyo., 82071

225. Willis, W. O. BIBLIOGRAPHY ON SOIL TEMPERATURE (THROUGH 1963). U.S. Dept. Agr., Agr. Res. Serv. ARS 41-74, 81 pp. 1964.

Soil temperature has a controlling influence on physical and biological processes associated with the soil mass. Plant growth and development, ion and water movement to the plant, and microbiological as well as chemical and physical reactions in the soil are governed by ambient temperatures and soil temperature gradients. Soil temperature is also an important factor in the related fields of hydrology and engineering.

Activity in research on soil temperature has increased in recent years. However, more work is needed and the complexity of the total problem serves to increase the challenge.

The following selected references were divided into the following two parts: (1) Books containing pertinent information; and (2) articles on particular aspects of soil temperature.

SWCRD, ARS, USDA, PIS, Beltsville, Md., 20705

226. Hardy, A. V. LOW TEMPERATURE PROBABILITIES IN NORTH CAROLINA. N.C. Agr. Expt. Sta. B. 423, 43 pp. 1964.

The effects of low temperatures on plant growth and agricultural production were discussed. From U.S. Weather Bureau climatological data for the period 1921-1960 for 55 stations, means and standard deviations were computed using the annual dates of latest occurrence in spring and earliest occurrence in fall of temperatures as low as 40°, 36°, 32°, 28°, 24°, 20°, and 16° F.

Charts, were prepared showing the dates after which (in spring) and before which (in fall) the probability of occurrence of each temperature is less than 90, 75, 50, 15, 10, and 5 percent.

Tables, maps, and charts.

Agr. Expt. Sta. N.C. State, U. N.C., Raleigh, N.C., 27607

227. Shulman, M. D. TEMPERATURES IN NEW JERSEY. N.J. Agr. Expt. Sta. C. 604, 8 pp. 1964.

The areal and temporal distribution, variability, and absolute values of temperature are extremely important to diverse groups. The growth of certain crops are dependent upon minimum, maximum, and range of temperatures. The location of certain industries, including health resorts, may be guided by the knowledge of seasonal temperature extremes. In the winter the type of precipitation we receive, liquid or solid, is a critical function of the temperature.

N.J. Agr. Expt. Sta., Rugers—The State U., New Brunswick, N.J., 08903

Surface Soil Removal

See 39.

Mulching

See Also 145.

228. Hale, V. Q., Stockton, J. R., and Dickens, L. PLASTIC AND PETROLEUM MULCHES FOR COTTON: AS AFFECTED BY SOIL TYPE AND LOCATION. Calif. Agr. 18(8): 10-12. 1964.

The effectiveness of plastic and petroleum mulches did not change in tests at two different locations on two different soil types in San Joaquin Valley cotton fields. Higher soil temperatures generated by all of the mulch test treatments resulted in earlier cotton germination and faster development, but ultimate plant sizes were the same. The mulches did not affect cotton quality, but shifted a greater percentage of the yield into the first picking. Although yield increases alone may not return the cost of treatment, reductions in hand labor made possible through precision planting as part of the mulching operation offer some compensation.

INFLUENCE OF ARTIFICIAL MULCHES ON YIELD AND EARLINESS OF COTTON

Treatment	Yield		First pick	
	Shafter	Five Points	Shafter	Five Points
	lbs. seed cotton/acre		%*	%
Check......................	2570	3425	62	67
Black plastic..............	2930	3982	75	76
Clear plastic..............	2840	3954	76	77
Petroleum mulch............	2870	3683	75	68
L.S.D. (5%).............	246	489		

*Percentage of total yield that was in first picking.

U. Calif., Davis, Calif., 95616

PLANT MANAGEMENT

Pasture and Haylands

See Also 38, 39, 67, 97, 100, 101, 107, 109, 112, 116, 121, 123, 126, 127, 128, 150, 151, 153, 154, 166, 168, 169, 171, 175, 178, 195, 196, 197, 211, 213, 239, 242, 243, 244, 246, 247, 250, 251, 252, 319, 356.

229. Andrew, F. W., Carlisle, G. R., Fryman, L. R., Wilken, D. F., and Pardee, W. D. ILLINOIS FORAGE HANDBOOK—PASTURE, HAY, AND SILAGE FOR DAIRY CATTLE, BEEF CATTLE, SHEEP, AND HOGS. Ill. Coop. Ext. Serv. C. 895, 16 pp. 1964.

Many acres on Illinois farms require continuous cover or cover crops during part of the rotation. On many farms, hay and pasture acreage represents a net loss to the farm business since the costs charged against these acres add up to more than the value of the crop harvested from them. Much of this loss can be explained by low yields and incomplete use of the forage crop produced. Unused forage has no value except for some indirect added fertility and soil conservation benefits.

The keys to profitable forage production are high yields and a well-managed livestock program that makes maximum use of the forage crops. This handbook was designed to help boost the profits from forage-producing acres.

U. Ill., Col. Agr., Coop. Ext. Serv., Urbana, Ill., 61803

230. Younge, O. R., Plucknett, D. L., and Rotar, P. O. CULTURE AND YIELD PERFORMANCE OF DESMODIUM INTORTUM AND D. CANUM IN HAWAII. Hawaii Agr. Expt. Sta. Tech. B. 59, 28 pp. 1964.

The culture and taxonomy of Desmodium intortum and D. canum (kaimi) were reported for Hawaii conditions. Six field experiments of intortum and kaimi in various mixtures with tropical grasses showed that intortum, when adequately fertilized, yielded in excess of 20,000 pounds dry matter per acre per year. Controlled grazing of intortum and grass mixtures gave beef liveweight gains of 800 pounds per acre per year with only moderate fertilization.

Kaimi clover stimulates yields of associated grasses, but is a poor yielder in pure culture. Cattle weight gains over a 4-year period averaged 600 pounds per acre on four kaimi and grass mixtures under low rates of fertilization.

Both intortum and kaimi showed marked response to P, K, Mo, and Zn on one or more common Hawaii soils. Additions of lime, Mo, and Zn gave marked increases in seed. The response of wetland soils to fertilization was dramatic with both legumes. Inadequate fertilization caused poor stands and low quality yields of Desmodium.

Adequately fertilized, the intortum was fully competitive with aggressive grasses, such as kikuyu, pangola, and dallisgrass. Kaimi was superior in forage mixtures where little or no fertilization and/or where overgrazing was practiced.

U. Hawaii, Col. Trop. Agr., Hawaii Agr. Expt. Sta., Honolulu, Hawaii, 96814

231. Parsons, J. L., and Davis, R. R. ESTABLISHMENT AND MANAGEMENT OF BIRDSFOOT TREFOIL IN OHIO. Ohio Agr. Expt. Sta. Res. B. 967, 19 pp. 1964.

Investigations concerned with problems of establishment and management of birdsfoot trefoil (Lotus corniculatus L.) were conducted during 1952-63. The authors concluded that:

1. Seeding rates of 4-6 lb./A. of trefoil produced adequate ground cover in the seeding year, and maximum yields thereafter.
2. Commercial inoculant applied as recommended on the label, preferably with a moistening agent assured inoculation of trefoil plants.
3. Birdsfoot trefoil is not a vigorous competitor and should not be seeded with legumes such as Ladino clover.
4. There was an advantage to band seeding trefoil without a companion crop where weeds were not likely to become a problem. The advantage of wide over narrow row-spacing of the companion crop was not large, and there was a possibility of greater weed growth with wide spacing. The preferred companion crop was oats, although considerable success was obtained with wheat and other fall-sown grain crops.
5. Once established, birdsfoot trefoil persisted successfully with most of the commonly used grasses in Ohio. As with other legumes, trefoil should be managed in a manner that will avoid very early spring or late fall harvests. Although yields were reduced, trefoil persisted under a 4-cutting hay management with orchardgrass. This type of management would have eliminated alfalfa stands.
6. Herbicides can be used in the successful establishment of trefoil. Tillage with a disk or plow in addition to herbicides improved the stands of trefoil and gave a better kill of previous sod. Fall treatment with dalapon 5 lb./A. or amitrol 2 lb./A. plus tillage permitted early spring planting and was preferred to spring application of chemicals. Amitrol should not be used in spring.

Tables and graphs.

Ohio Agr. Expt. Sta., Wooster, Ohio, 43210

232. Hawk, V. B., and Shrader, W. D. SOIL FACTORS AFFECTING CROWNVETCH ADAPTATION. J. Soil and Water Conserv. 19(5): 187-190. 1964.

Crownvetch is best adapted to permeable, well-drained, calcareous soils, but it will grow under neutral to slightly acid conditions. Slowness of establishment is probably related to low levels of available phosphorus in the plow layer. Once established, however, crownvetch will persist on soils very low in available phosphorus.

Crownvetch growth may be related to available potassium. However, data from laboratory tests for available soil nutrients alone will not permit identification of sites where crownvetch will succeed or fail.

Of all criteria studied, soil wetness was the most critical in delineating areas where seedings of crownvetch will succeed. Thus, this soil characteristic will probably be the key to separation of areas of adaptation of crownvetch and birdsfoot trefoil in Iowa. Birdsfoot trefoil makes a good growth on wet sites on which crownvetch cannot survive. On cut slopes, careful study of the soil horizons exposed should be made before seeding either legume for permanent plant cover. Where there is a mixture of soil conditions on critical areas, it is practical to mix crownvetch and birdsfoot trefoil.

SCS, USDA, Ames, Iowa, 50010

233. Williamson, R. E., and Willey, C. R. EFFECT OF DEPTH OF WATER TABLE ON YIELD OF TALL FESCUE. Agron. J. 56(6): 585-588. 1964.

In the greenhouse, where only subsurface watering was used, the yield of Kentucky 31 fescue was approximately the same for water table depths of 9 and 17 inches; but a 29-inch water table treatment resulted in a highly significant reduction in yield.

In the growth chamber, where a combination of surface and subsurface watering was used, the maximum yield was obtained at a water table depth of 16 inches. Nitrogen applications tended to equalize the yield obtained from 8-, 16-, and 24-inch water table treatments. For the 8-inch depth, however, the nitrogen supplied was not adequate and the yield dropped off considerably in the third to fourth week after nitrogen was applied.

Oxygen diffusion and partial pressure measurements indicated that only the top few inches of soil were well aerated with 8-inch or 9-inch water tables. Most of the fescue roots were concentrated in the upper 4 inches of soil and the yield was not affected greatly by the shallow water table. Because of this shallow rooting habit, fescue is susceptible to overdrainage with consequent loss of yield due to drought condition.

SWCRD, ARS, USDA, Raleigh, N.C., 27607

234. Bennett, H. W., and Merwine, N. C. INTERPLANTED LEGUMES IN JOHNSONGRASS. Miss. Agr. Expt. Sta. B. 698, 11 pp. 1964.

All fertilizer and interplanted legume treatments increased the yields of Johnsongrass. Yields were significantly increased the first year by interplanted roughpea and by roughpea, black medic, and Persian clover.

Increases in yield of Johnsongrass due to potash were negligible, and yields the second year were practically the same as those of the first year.

The application of 32 pounds of nitrogen increased the yield of Johnsongrass approximately 36 percent, and this increase was constant for the 2 years.

The three rates of phosphorus applied alone or in combination increased yields the second year. The yield following phosphorus alone the second year was the same as that from nitrogen alone. All fertilizer treatments containing phosphorus gave significant responses, and the responses increased in the second year over the first.

Use of phosphorus with nitrogen increased the efficiency of nitrogen in the production of Johnsongrass. This increase was greater (15 percent) when used with an interplanted legume.

The addition of phosphorus increased the yield of Johnsongrass owing to the increased growth of interplanted legumes.

The calcium content of the legumes was not altered by the addition of fertilizers.

The average phosphorus content of the legumes was increased 30 percent by applications of phosphate alone or in combination with nitrogen or potash, or with both.

The crude protein of the legumes was increased by nitrogen and phosphate.

The phosphorus content of Johnsongrass was increased by application of fertilizers. This increase was greater following interplanted legumes.

The crude protein content of Johnsongrass was increased by fertilizer. This increase was due to applications of nitrogen alone or in combination with other fertilizers. The increases were greater with interplanted legumes.

Miss. State U., Agr. Expt. Sta., State College, Miss., 39762

235. Browning, C. B., and Lusk, J. W. COMPARISON OF SILAGE AND HAYLAGE FOR DAIRY CATTLE. Miss. Agr. Expt. Sta. B. 699, 7 pp. 1964.

Wilted sudangrass (30-35 percent DM (dry matter)) silage was successfully stored in conventional concrete tower silos with low dry-matter losses from spoilage and fermentation when proper technique was used.

Wilted sudangrass silage and direct-cut grain sorghum silage from conventional storage compared favorably in chemical composition, digestibility, and feeding value with the same forages stored under gas tight conditions.

Greater attention to ensiling detail is required if high quality forages with low storage losses are to be attained with conventional storage rather than with gas-tight storage. However, factors such as selection of crop, stage of maturity, and proper harvesting procedures would appear to be more important to the quality of silage than the type of storage structure used.

Miss. State U., Agr. Expt. Sta., State College, Miss., 39762

236. Scarborough, E. N., ed. HAY DRYING IN THE NORTHEASTERN UNITED STATES. Del. Agr. Expt. Sta. B. 349A (Northeast Reg. P.) 17 pp. 1964.

Unfavorable conditions for field curing quality hay have caused many northeast farmers to use mow and batch dryers.

Proper field handling prior to drying is essential for the production of quality hay. Time of mowing, conditioning, raking to control drying rate, hay moisture content when baled or chopped, and storage density are of prime importance. Baling or chopping should begin when the moisture content reaches 40-45 percent and should end before the hay reaches 30 percent. Bale densities of 5 to 7 pounds per cubic foot when dried to 15 percent moisture have proved to be superior.

In-storage drying is practiced in the inland areas. Units are usually confined to 100 tons or less, with the final depth of hay being the limiting factor. Drying time for each layer added will vary from 3 days to 2 weeks, depending on weather conditions.

Heated air dryers are usually of the batch type, and their capacities are not limited by storage volume. Each day's harvest is dried separately and placed in storage after drying. Wagon dryers, which require less labor and handling than platform dryers, have proved to be the most satisfactory type.

The efficiency of the drying operation may be improved by recirculating part of the drying air, but the resulting decreased fuel cost must be balanced against higher fixed costs.

Charts and photographs.

U. Del., Agr. Expt. Sta., Newark, Del., 19711

237. Blosser, R. H. ECONOMICS OF PRODUCING ALFALFA FOR DEHYDRATING PLANTS IN OHIO. Ohio Agr. Expt. Sta. Res. B. 968, 10 pp. 1964.

Figures in the table show that an acre of alfalfa sold to a dehydrating plant for $11 a ton when dried gave about the same profit as an acre of hay which sold for $21.25 a ton at the farm. Receipts for dehydrated meadows were based on four cuttings which produced 3.5 tons per acre of dried alfalfa and receipts for hay were figured for three cuttings which produced 3.5 tons per acre. These yields represent the estimated normal production for the two different methods of harvesting meadows. Costs of producing alfalfa for hay and dehydration were based on keeping the crop 3-years in the rotation.

Prices used in figuring costs were $1.50 per hour for all labor and $1.25 per hour for the tractor power used.

TABLE — Receipts, Expenses and Profits Per Year from an Acre of Hay and an Acre of Meadow Sold to a Dehydrating Plant.

Item	Meadow Harvested as Hay	Meadow Sold to Dehydrating Plant
Receipts	$74.40	$38.50
Expenses		
Man Labor	13.50	.30
Tractor Power	7.25	.25
Machinery	13.75	.05
Fertilizer	4.50	4.50
Lime	1.00	1.00
Seed	1.65	1.65
Baler Twine	2.25	.00
Land	18.00	18.00
Total	61.90	25.75
Profit Per Acre Per Year	12.50	12.75

On an individual crop basis, calculations showed that 3.5 tons of dried alfalfa which was sold to a dehydrating plant for $11 a ton gave about the same profit per acre as 71 bushels of corn that sold for $1.00 a bushel at the farm, 27 bushels of soybeans at $2.25, 36 bushels of wheat at $1.75, 95 bushels of oats at $0.65 or 3.5 tons of hay at $21.25 a ton at the farm.

When dried alfalfa brings the farmer an average of $11.00 a ton, alfalfa meadows can be profitable marketed through dehydrating plants when one or more of the following situations exist: The meadow must be located near a dehydrating plant; the farmer does not need the meadow for livestock feed; additional labor must be hired to harvest the meadow as hay; and the average selling price for hay is $21.25 or less per ton at the farm.

Ohio Agr. Expt. Sta., Wooster, Ohio, 43210

See Also 123, 139, 243, 244, 245, 246, 256, 266, 356, 357.

238. Hull, A. C., Jr., and Holmgren, R. C. SEEDING SOUTHERN IDAHO RANGELANDS. U.S. Forest Serv. Res. Paper INT-10, 31 pp. 1964.

Available information and experience were summarized to serve as a guide to range seeding. Recommendations were based primarily on results of experimental seedings made since 1936 in southern Idaho. More than 230 species have been planted in more than 13,000 plots at 79 locations. Many large-scale seedings have been observed, to check the soundness of recommendations for species, methods, and management practices. Published information was reviewed and additional information previously unpublished was presented.

The studies were planned to determine adapted species and to develop effective methods of seeding southern Idaho rangelands. Many of the seedings were grazed. The relative palatability and grazing tolerance of individual species were shown. The studies and large seedings have shown that seeding can be a profitable investment.

Intermountain Forest and Range Expt. Sta., FS, USDA, Ogden, Utah, 84403

239. Hedrick, D. W., Hyder, D. N., and Sneva, F. A. OVERSTORY-UNDERSTORY GRASS SEEDINGS ON SAGEBRUSH-BUNCHGRASS RANGE. Oreg. Agr. Expt. Sta. Tech. B. 80, 3 pp. 1964.

Crested wheatgrass, beardless wheatgrass, and big bluegrass were seeded as overstory grasses. Streambank wheatgrass, canby bluegrass, bulbous bluegrass, and Ladak alfalfa were seeded as companion species. Pure and mixed stands were seeded on sagebrush-bunchgrass range in eastern Oregon to compare yield and competitiveness. The grasses were planted in 1956-58, and half of each plot was fertilized with ammonium nitrate at 20 or 30 lb. N/A. The plots were evaluated for 4 years after planting.

Yields of overstory grasses in pure stands exceeded those in mixed stands. Nitrogen fertilization increased yields about 45 percent, but did not increase seeding success on fallowed or burned seedbeds or alter greatly either competitive status or plant composition.

Relative yields of individuals in mixed stands (yields expressed in percent of that in a pure stand) were computed to indicate competitive status and compatibility. Crested wheatgrass was highly competitive, producing 90 percent with canby bluegrass and 82 percent with streambank wheatgrass. Beardless wheatgrass and big bluegrass were about equally, but weakly to moderately, competitive.

Crested wheatgrass in either pure or mixed stands practically eliminated all herbaceous weeds in the second growing season. All grasses except bulbous and canby bluegrass provided effective weed control by the fourth growing season. Crested and streambank wheatgrasses, and mixtures including them, permitted the establishment of fewer brush than other species. Brush became established in the seeding years in greater numbers than in any single year thereafter.

Big bluegrass was continually and severely suppressed by companion understory grasses and should be planted in pure stands. Understory grasses with crested wheatgrass offered little advantage or disadvantage. Beardless wheatgrass and canby bluegrass were reasonably compatible and provided a mixed stand that could be recommended as preferable to beardless wheatgrass in a pure stand.

Agr. Expt. Sta., Oreg. State U., Corvallis, Oreg., 97331

240. Dwyer, D. D., and Elder, W. C. GRAZING COMPARISON OF WOODWARD SAND BLUESTEM AND CADDO SWITCHGRASS IN OKLAHOMA. Okla. State U. Expt. Sta., B. B-628, 12 pp. 1964.

Two 8-acre pastures of selected strains of native grass were planted on a fine sandy loam soil in 1957 on the Paradise Experiment Station, Paradise, Okla. One pasture was planted to Caddo switchgrass (Panicum virgatum) and one to Woodward sand bluestem (Andropogon hallii). Grazing comparisons of the two species began in the spring of 1961.

When grazed at a rate which was not detrimental to the switchgrass, the animal gain was reduced in August and September because the grass-matured seed and the leaves dried. When grazed at a rate that kept switchgrass from maturing quite so early, gains stayed up, but the grass was injured owing to overgrazing.

The animal gains on sand bluestem were consistently high, and the grass was not injured by the grazing rates imposed. Bluestem produced nearly 1,300 pounds more forage per acre than did switchgrass in 1963—4,522 pounds to 3,245 pounds. Only 55 percent of the forage was required to support seven steers for 146 days on the bluestem, but 74 percent of the switchgrass.

Both grasses appeared to be far superior to the standard unselected native grass mixture adapted to the same site.

Tables and photographs.

Okla. State U., Expt. Sta., Stillwater, Okla., 74075

241. Hickey, W. C., Jr., and Garcia, G. CHANGES IN PERENNIAL GRASS COVER FOLLOWING CONVERSION FROM YEARLONG TO SUMMER-DEFERRED GRAZING IN WEST CENTRAL NEW MEXICO. U.S. Forest Serv. Res. Note RM-33, 3 pp. 1964.

Ground cover changes, production, and utilization of alkali sacaton, galleta, and blue grama were measured during 6 years of yearlong grazing and then during 6 years of summer-deferred grazing.

Under yearlong grazing, these perennial grasses declined; under summer-deferred grazing, they increased.

Under summer deferment, the ground cover index showed a marked change. Alkali sacaton increased 400 percent, Galleta 359 percent and blue grama 206 percent on the average for the three watersheds tested.

Rocky Mountain Forest and Range Expt. Sta., FS, USDA, Fort Collins, Colo., 80521

Plant Materials

See Also 38, 153, 178, 232, 278, 282.

242. Slinkard, A. E. OAHE INTERMEDIATE WHEATGRASS. Idaho Agr. Expt. Serv. B. 427, 5 pp. 1964.

Oahe (Oh-wah-hee) is a variety of intermediate wheatgrass developed for high seed and forage yield by the South Dakota Agricultural Experiment Station. Selfed and open pollinated progenies of Ree wheatgrass were selected for high seed-set, forage yield, and rust resistance. Four superior clones were chosen to make this synthetic variety.

Plants of Oahe are uniform for blue-green color, strong vigor, an abundance of leaves, large seeds, and high seed yield. It has larger and coarser stems than Greenar intermediate wheatgrass. Oahe is similar to Greenar in that it is sod-forming and late-maturing.

Oahe is used primarily for hay, pasture, and green manure. It is best adapted to those areas where annual precipitation varies from 13 to 25 inches. It will grow readily in all areas where Greenar has been grown successfully.

Oahe was superior in seed and forage production to other varieties of intermediate wheatgrass over a wide range of environmental conditions.

Idaho Agr. Ext. Serv., U. Idaho, Col. Agr., Moscow, Idaho, 83843

Soil Conservation Service. GRASS IN CONSERVATION IN THE UNITED STATES. U.S. Dept. Agr. Soil Conserv. Serv. SCS-TP-143, 43 pp. 1964.

This technical publication on grass in soil and water conservation in the United States contains the following articles:

243. Williams, D. A. GRASS IN SOIL AND WATER CONSERVATION.

244. Blakely, B. D. GRASS IN CONSERVATION FARMING.

245. Allred, B. W. CONSERVATION OF PRIVATE RANGELAND.

246. Hafenrichter, A. L., and Stoesz, A. D. NEW PLANT MATERIALS FOR CONSERVATION FARMING AND RANCHING.

In addition to the literature cited section, a bibliography of publications on grasses and legumes was given that was written by technicans of the Soil Conservation Service.

SCS, USDA, Inform. Div., Washington, D.C., 20250

247. Kretschmer, A. E., Jr. BERSEEM CLOVER, A NEW WINTER ANNUAL FOR FLORIDA. Fla. Agr. Expt. Sta. C. S-163, 16 pp. 1964.

The advantage of berseem clover over other clovers and alfalfa is its fast winter growth rate. Additional feed in January, February, and March is of primary concern to cattlemen and dairymen. An average dry temperature of about 54° F. was required for vigorous growth. Cold temperatures in north Florida would limit the use of berseem clover. Where temperatures normally reach 25° F. in the winter, berseem clover should be seeded before November 1. Mature plants can withstand much lower temperatures than seedlings. Berseem clover probably should not be planted where temperatures reach the low 20's or below several times during the winter.

It has been reported that berseem clover has a drought tolerance similar to alfalfa. Observations in Florida indicate that berseem clover can tolerate more soil moisture than alfalfa.

Although the multi-cut varieties Miscawi, Nile, and Hustler are recommended for use in Florida at this time, the Fahl (single-cut) may have a place if further tests show that it will produce enough early forage. In areas where corn or sorghums are seeded in the early spring, an early fall planting of Fahl may fill the feed gap in the winter, and still permit time to plant corn on the same land.

Even though there have been no reports of bloat of cattle from berseem clover, care should be taken to observe animals carefully when they are first fed this legume.

Berseem clover can be seeded in mixture with white clover to newly planted pasture to boost first-year yields. This will not prevent seed production of the white clover, and will provide additional nitrogen for summer grass growth. It can also be successfully grown with oats or rye. It is suggested that commercial plantings be made to clean cultivated soils or newly planted grass pastures.

U. Fla., Agr. Expt. Sta., Gainesville, Fla., 32603

248. Brooks, R. M., and Griggs, W. H. FIVE NEW SWEET CHERRY VARIETIES. Calif. Agr. Expt. Sta. B. 806, 20 pp. 1964.

Five new sweet cherry varieties were introduced for commercial trial in California. Jubilee and Bada are presently free of known virus diseases. The other new introductions are known to carry a latent virus which is considered of minor importance in sweet cherry culture.

The apparent superior characteristics and weaknesses of the new varieties were discussed in the following descriptions:

1. Mona is a red to dark-red cherry that is larger, firmer, and less tart than Black Tartarian. Mona ripens at the same time as Black Tartarian. The tree is spreading.
2. Larian is a glossy, dark-red cherry, superior to Black Tartarian in size, firmness, and flavor; Larian matures more than a week earlier than Bing. This new variety is relatively free of fruit doubles, and is more resistant to cracking than Bing.
3. Jubilee is a high-quality supplement to Bing, red to dark red and nearly as firm as Bing but produces practically no doubles. Jubilee's cracking-resistance is similar to that of Bing, Jubilee ripens a few days before Bing and has a long harvest season.
4. Berryessa is a cream-colored, red-blushed cherry which may supplement or replace Royal Ann. Berryessa is superior to Royal Ann in size and flavor, ripens earlier, is more resistant to bruising, and produces relatively few fruit doubles.
5. Bada is a glossy, cream-colored cherry with medium to high blush, being a supplement or replacement for Royal Ann, since Bada does not produce fruit doubles and has a high resistance to fruit-cracking. Its average size is near that of Royal Ann.

Tables and photographs

Calif. Agr. Expt. Sta., U. Calif., Davis, Calif., 95616

249. Leonard, W. H., Hinze, G. O., Mann, H. O., and Swink, J. SORGHUM OPEN-PEDIGREE HYBRIDS IN COLORADO. Colo. Agr. Expt. Sta. B. S-520, 27 pp. 1964.

Since their introduction on Colorado farms in 1957, grain sorghum hybrids have increased to where an estimated 90 percent of the irrigated acreage and 70 to 75 percent of the dryland acreage of the State were planted to hybrids in 1963.

Three new grain sorghum open-pedigree hybrid varieties, developed in Colorado, were released in 1964. Colorado 585 is adapted to northeastern Colorado drylands. Colorado hybrids 606 and 604 are productive under dryland conditions in southeastern Colorado. Colorado 606 has also produced high yields under irrigated conditions in the Arkansas Valley.

Sorghum open-pedigree hybrids have been grown in comparison with common varieties under dryland conditions in northeastern Colorado, at Akron, since 1956. Adapted hybrids are; Colorado 585; Nebraska 504; Nebraska 505; RS-608; and RS-610. Common varieties still recommended in the region are: Combine 7078; Early Hegari; Norghum; and Reliance. Sorgo open-pedigree hybrid varieties suitable in the region are Nebraska 304F and RS-301F. Common sorgo varieties still grown are Black Amber (F.C.I. 7038) and Fremont.

Dryland sorghum hybrid yield tests have been conducted on the Southeastern Colorado Branch Station at Springfield since 1956. Grain sorghum open-pedigree hybrids adapted in the region are: Colorado 604; Colorado 606; Nebraska 504; Nebraska 505; RS-608; and RS-610. Common grain sorghum varieties still grown in the region are: Bonita; Combine 7078; Early Hegari; Combine Kafir-60; Martin; and Norghum. Sorgo varieties adapted to the region are: Nebraska 304F (hybrid), Black Amber (F.C.I. 7038); Early Sumac; Ellis; and Leoti.

Sorghum hybrid varieties have been tested under irrigation in southeastern Colorado since 1956. Adapted grain sorghum open-pedigree hybrids are: Colorado 606, RS-608; RS-610; and RS-650. Common grain sorghum varieties recommended in the region are: Bonita; Combine 7078; Combine Kafir-60; and Early Hegari. Nebraska 304F is an adapted sorgo open-pedigree hybrid, whereas recommended common sorgo varieties are: Axtell, Early Sumac, Ellis; Fremont; and Leoti.

Nebraska 280-S is a sudangrass open-pedigree hybrid recommended in eastern Colorado for forage production.

Agr. Expt. Sta., Colo. State U., Fort Collins, Colo., 80521

250. Hart, R. H., Burton, G. W., and Morey, D. D. SMALL GRAIN VARIETIES FOR WINTER FORAGE IN THE GEORGIA COASTAL PLAIN. Ga. Agr. Expt. Sta. B. N.S. 121, 18 pp. 1964.

Small grains are the preferred species for winter grazing in the Georgia Coastal Plain because they are tolerant of drought and cold and produce high yields of high quality forage. Rye was recommened for mid-winter grazing as it was the most cold- and drouth-tolerant and the earlier of the three species tested.

Oats were recommended for spring grazing, as they were more heat-tolerant than rye, produced higher yields, and probably higher quality forage in the spring. Wheat was later than rye and less heat-tolerant than oats and had no particular advantages for grazing. Recommended varieties for grazing were: Wrens Abruzzi and Explorer rye; and Fairfax, Suregrain, and Moregrain oats.

Fairfax oats were the best choice for silage, with Explorer rye, Bledsoe wheat, and several oat varieties somewhat lower in yield, but still satisfactory. Wrens Abruzzi and Explorer rye were considered the best varieties to provide a combination of early grazing and silage.

Ga. Agr. Expt. Sta., U. Ga. Col. Agr., Athens, Ga., 30601

251. Carlson, I. T. EFFECTS OF ROW SPACING AND FERTILIZER TREATMENT ON SEED YIELD AND RELATED TRAITS OF "STERLING" ORCHARDGRASS. Agron. J. 56(6): 565-569. 1964.

The seed production of Sterling orchardgrass was studied under several fertilizer treatments in each of four row-spacing and planting method combinations. Rows spaced 24 inches apart averaged higher in seed yield than 9- or 36-inch rows. The greatest response to the fertilizer treatments was obtained in 9-inch rows and the least in 36-inch rows. A response to nitrogen fertilization was obtained each year. Yields from plots treated with N, P, and K were similar to those treated with N alone in 1960. In 1961 and 1962, N, P, and K treatments increased yields markedly over N alone in 9-

and 24-inch rows. Results from 9-inch rows indicated that the response to the P and K combination was due primarily to the P. Early April application was more effective than application in early September in 24- and 36-inch rows; but the opposite was true in 9-inch rows. When fertilizer application was delayed until spring, 9-inch rows seeded alone yielded considerably more seed in the first harvest year than those seeded with an oat companion crop. There was a downward trend in the average annual yield of each row spacing except the 36-inch rows, which increased slightly from 1961 to 1962.

The effects of the fertilizer treatments on seed yield and number of panicles per unit area were similar. Spring application of the treatments resulted in more seed per panicle and higher weight per 100 seeds except when the grass lodged. Seed weight was reduced considerably when moderate to severe lodging occurred. Panicle size increased and panicle number decreased as width between rows increased.

Iowa Agr. and Home Econ. Expt. Sta., Iowa State U. Sci. and Tech., Ames, Iowa, 50010

252. Austenson, H. M., and Peabody, D. V., Jr. EFFECTS OF ROW SPACING AND TIME OF FERTILIZATION ON GRASS SEED PRODUCTION. Agron. J. 56(5): 461-463. 1964.

S-143 (Wash.) orchardgrass, Climax timothy, red fescue, and colonial bentgrass were grown for 3 years in 7- (solid) and 42-inch rows. Annual fertilization at the rate of 60-26-50 (N-P-K) was applied on September 15 and March 15, or in two applications—half in September and half in March.

Orchardgrass and timothy seed yields were significantly higher in the wide rows. In both species, row yields declined more rapidly each year than did the solid stand yields. Red fescue seed yields were not affected by row spacings. Colonial bentgrass seed yields were higher in solid stands than in rows.

In orchardgrass, split applications of fertilizer gave highest yields in rows and fall application gave highest yields in solid stands. Seed yields of timothy were not affected by time of fertilization. Red fescue and colonial bentgrass seed yields were highest when all or part of the fertilizer was spring applied. Germination and purity were not affected by row width or time of fertilization in any of the four species.

Air-dry straw weights of orchardgrass and timothy were not affected by row spacing. Red fescue and colonial bentgrass straw weights were much higher in solid stands than in rows. Time of fertilization had no appreciable effect on straw yield of any of the species.

Seed yields of orchardgrass, red fescue, and colonial bentgrass were significantly correlated with straw yields. In timothy, there was no relationship between seed and straw yields.

Lodging of orchardgrass and timothy was greater in solid stands than in rows, and was greater when all or part of the fertilizer was applied in the spring than when it was all applied in the fall. In red fescue and colonial bentgrass, lodging was nearly complete regardless of treatment.

Timothy plant heights were greater in rows than in solid stands, but were not affected by time of fertilizer application. In the other three species, plant height was independent of any of the treatments.

Western Wash. Expt. Sta., Puyallup, Wash., 98371

See Also 101, 108, 124, 129, 149, 156, 198, 213, 351, 352, 353, 356, 357.

Soil Conserv. 30(3): 51-71. Oct. 1964.

This issue of the Soil Conservation Magazine was devoted to articles on woodland conservation. The following articles were given:

253. Plair, T. B. KEY GOALS FOR CONSERVATION: SOIL CONSERVATION DISTRICTS SUPPORT AFA PROGRAM ON NATION'S PRIVATE WOODLANDS. SCS, USDA, Washington, D.C., 20250

254. Henninger, C. M. LUMBER IS OUR CROP: TENNESSEE BROTHERS HARVEST PINE AND HARDWOODS FROM TIMBERED HILLS NEAR COPPER BASIN. SCS, USDA, Cleveland, Tenn., 37311

255. Cooper, J. M., and Ray, M. D. BRADY'S HILLS SKI AREA: FAMILY FARM RECREATION PLAN REALIZES DREAM OF FOUR GENERATIONS IN MICHIGAN WOODS. SCS, USDA, Stanton, Mich., 48888

256. Atkins, M. D. THE SEARCH FOR "ECOTYPES": SPECIAL STRAINS OF GRASSES BRING SUCCESS TO PLANTINGS IN SPECIFIC AREAS. SCS, USDA, Denver, Colo., 80225

257. Anonymous. IN MONTANA'S CLARK FORK VALLEY...CONSERVATION DISTRICT BUILDS WOODLAND ECONOMY.

258. Lemmon, P. E. SOILS INFORMATION FOR WOODLAND PLANNING. SCS, USDA, Washington, D.C., 20250

259. Ridenour, W. J. OHIO CONSERVATION DISTRICT AIDS WATER DEVELOPMENT. SCS, USDA, Jackson, Ohio, 45640

260. Pomeroy, K. B. AMERICAN FORESTRY ASSOCIATION SPONSORS MULTIPLE USE, CONSERVATION. Amer. Forestry Assoc., Washington, D.C., 20006

261 Richardson, D. L. SCHOOL FOREST PROVIDES INCOME AND TEACHING AREA. SCS, USDA, Tallulah, La., 71282

262. Williams, D. A. WOODLANDS IN THE CONSERVATION PROGRAM. SCS, USDA, Washington, D.C., 20250

263. Curtis, R. O., and Post, B. W. BASAL AREA, VOLUME, AND DIAMETER RELATED TO SITE INDEX AND AGE IN UNMANAGED EVEN-AGED NORTHERN HARDWOODS IN THE GREEN MOUNTAINS. J. Forestry 62(12): 864-870. 1964.

Plot measurement data collected in the course of a soil-site study in northern hardwoods in the Green Mountains of Vermont provided the basis for some comparisons of basal area, cu.-ft. volumes, and diameters by age and site index. The principal results were:

1. A composite site index was presented that permitted comparisons on a common basis of stands of mixed species composition.
2. The basal areas of apparently fully stocked even-aged northern hardwood stands were related to both age and site index. Estimating equations were presented.

3. An equation was given for estimating total cu.-ft. volume of apparently fully stocked stands from age and site index. Within the range of the data, the relationship was very nearly linear with respect to age.
4. The current annual net increment within the range of the data appeared to be at least roughly comparable to the mean annual net increment. Its mean value was 46 cubic feet per acre per year, with a total range from 23 to 77 at the extreme values of composite site index included in the sample.
5. Equations were given that relate the mean diameters of dominants of sugar maple, white ash, yellow birch, and white birch to age and composite site index. Some comparisons were made between the relative rates at diameter growth of these species within and between sites.

Pacific Northwest Forest & Range Expt. Sta., FS, USDA, Olympia, Wash., 98501

264. Curtis, J. D. WHAT DO YOU MEAN, "SITE PREPARATION"? U.S. Forest Serv. Res. Note INT-15(rev.) 8 pp. 1964.

Successful regeneration of many forest tree species requires planned treatment of the site, commonly called "site preparation." Such treatment can be accomplished by mechanical means, by use of chemicals, or by burning. The amount and kind of site treatment needed depend on local conditions, silvical requirements, and costs. Because there are many ways in which a forest area can be treated and because the forester must strive to prevent loss of soil from the site, an understanding of site preparation terms is important. The methods frequently used by foresters in the course of preparing ground for regeneration were described.

Intermountain Forest and Range Expt. Sta., FS, USDA, Ogden, Utah, 84403

265. Broadfoot, W. M. GUIDE FOR EVALUATING WILLOW OAK SITES. U.S. Forest Serv. Res. Paper SO-13, 7 pp. 1964.

Three methods of estimating the rate at which willow oak (Quercus phellos L.) will grow on forest soils of the Midsouth were described. The methods were developed by the Southern Hardwoods Laboratory from measurements of sample trees on 156 plots representing a wide variety of soils and site conditions. Each expresses site index as the total height in feet of a 50-year-old tree that has grown as a dominant in a well-stocked stand.

In the first of the new methods, site is estimated from four factors: Clay content of the soil at depths of 36 to 48 inches below the surface; depth to mottling; inherent moisture condition of the site; and presence of hardpan. Three of the factors can be easily determined in the field, and clay content is readily derived by soil analysis in the laboratory.

The second approach is a fast field evaluation made by estimating soil texture and determining depth to distinct mottling, presence of hardpan, and inherent moisture condition.

In the third method, soil series and phase are obtained either from a soils map or by field identification, after which site index is read from a table.

The methods are intended for sites that have always been in forest. They may be inaccurate for abandoned fields, where physical and chemical conditions of the soil are often poor and seedlings may grow slowly during their early years.

Southern Forest Expt. Sta., FS, USDA, New Orleans, La., 70113

266. Dwyer, D. D., and Santelmann, P. W. A COMPARISON OF POST OAK-BLACKJACK OAK COMMUNITIES ON TWO MAJOR SOIL TYPES IN NORTH CENTRAL OKLAHOMA. Okla. State U. Expt. Sta. B. B-626, 15 pp. 1964.

The influence that soil type has on the vegetative cover was determined in post oak-blackjack oak communities in central Oklahoma. Two sites each were selected for study on the Darnell and Stephenville soil types near Stillwater, Okla.

Post oak was dominant on all sites but was less abundant on the Stephenville than on the Darnell soil type. Blackjack oak appeared to prefer the deeper, more productive Stephenville soil. There was greater diversity of species on the Stephenville soil.

The basal area of the overstory was 53.3 square feet per acre on the Darnell and 73.2 square feet on the Stephenville soil. There were slightly more trees and saplings per acre on the Darnell soil.

Andropongon scoparius and *A. gerardi* were the two dominant grass species on both soil types. *Rhus radicans* and *Cornus drummondii* were the most abundant broadleaved understory plants on the Stephenville soil, but did not occur or were rare on the Darnell; and *Symphoricarpos orbiculatus*, the most abundant on the Darnell rarely occurred on the Stephenville soil. Forbs were relatively unimportant on both soil types.

Approximately 90 percent of the trees on both soils were in the 3- to 6-inch diameter class. The over average d.b.h. of blackjack was greater than post oak in both soil types.

Both post oak and blackjack oak were consistently taller at all diameters on the Stephenville than on the Darnell soil.

Limited annual ring counts indicated that it requires around 40 years for post oak or blackjack to reach 5 to 6 inches d.b.h. and 22 to 25 feet in height on the Stephenville soil.

Tables and photographs.

Okla. State U. Expt. Sta., Stillwater, Okla., 74075

267. Richards, N. A., and Stone, E. L. THE APPLICATION OF SOIL SURVEY TO PLANTING SITE SELECTION: AN EXAMPLE FROM THE ALLEGHENY UPLANDS OF NEW YORK. J. Forestry 62(7): 475-480. 1964.

More than a decade has passed since it was realized that red pine was unsuited to the imperfectly and poorly drained soils covering extensive portions of the Allegheny Uplands in New York. However, this knowledge has yet to be effectively implemented in planting site selection. This relatively simple example of the application of soil survey to forest planting site selection was discussed, with particular emphasis on relating the soil units of soil surveyors to forest planting site units. Red pine responses to soil differences in this region are impressive, particularly when the economic implications of these differences are viewed. The most promising advances in site selection might be gained by better interpretation and use of published county surveys of the National Cooperative Soil Surveys wherever available.

The training of foresters and planting crew supervisors to recognize critical soil differences in their area was suggested both to improve control where adequate surveys are lacking and to supplement existing survey maps.

State U. Col. Forestry, Syracuse, N.Y., 13202

268. Myers, C. A. VOLUME TABLES AND POINT-SAMPLING FACTORS FOR PONDEROSA PINE IN THE BLACK HILLS. U.S. Forest Serv. Res. Paper RM-8, 16 pp. 1964.

The tables presented can be used to determine the volumes of ponderosa pine (Pinus ponderosa Laws.) in the Black Hills of South Dakota and Wyoming. They provide timber cruisers and growth estimators with the following: (1) Gross volumes in total and merchantable cubic feet; (2) gross volumes in board feet, International 1/4-inch, and Scribner log rules; (3) point-sampling factors for merchantable cubic feet and board feet; and (4) distribution of board foot volume among the logs of a tree.

Volume on an area may be determined from: (1) Measurements of tree diameters and heights; (2) measurements of diameters and of sufficient heights to convert the appropriate volume tables to local volume tables (Chapman and Meyer, 1949); or (3) tree counts obtained by point-sampling.

Sample trees were measured in all areas of commercial ponderosa pine in the Black Hills of South Dakota and Wyoming and the Bear Lodge Mountains of Wyoming.

Volumes were in total cubic feet and cubic feet to a 4.0-inch top, board feet Scribner Rule to an 8-inch top, and board feet International 1/4-inch Rule to an 8-inch top. Tree heights were in feet and numbers of logs. Volume equations were of the form $V = a+bD^2H$. Volumes per square foot of basal area were also included.

Rocky Mountain Forest and Range Expt. Sta., FS, USDA, Fort Collins, Colo., 80521

269. Schubert, G. H., and Fowells, H. A. SOWING RATES FOR REFORESTATION BY THE SEED-SPOTTING METHOD. U.S. Forest Serv. Res. Note PSW-44, 9 pp. 1964.

The procedure for estimating sowing rates depends upon randomness of events and on good estimates of germination and expected survival. Obviously, these conditions will seldom be completely satisfied. But the experienced planter should know about what the germination of his seed is and should be able to estimate what the survival might be. With such estimates, the planter can use the curves and tables presented to guide his planting rates. To be on the conservative side, he should plant more spots per acre rather than more seeds per spots and thereby run the risk of having over-stocked spots.

Pacific Southwest Forest and Range Expt. Sta., FS, USDA, Berkley, Calif., 94701

270. Wilde, S. A., Iyer, J. G., Tanzer, C., Trautmann, W. L., and Watterston, K. G. GROWTH OF JACK PINE (PINUS BANKSIANA, LAMB.) PLANTATIONS IN RELATION TO FERTILITY OF NON-PHREATIC SANDY SOILS. Soil Sci. 98(3): 162-169. 1964.

The results were reported of a Wisconsin survey of soils and growing stock of 16- to 30-year-old plantations of jack pine (Pinus banksiana, Lamb.) established on non-phreatic sandy soils. Surveyed plantations were subdivided into three classes determined by the following average annual height growth of dominant and codominant trees of average diameter: From 9 to 13 inches; from 14 to 17 inches; and from 18 to 23 inches. The growth of these three groups of plantations was estimated, at the average survival and the age of 40 years, to yield 11, 20, and 32 cords per acre, respectively.

In simple correlation, the annual height growth of plantations was strongly correlated with: Soil exchange capacity; soil texture; and contents of organic matter, total nitrogen, available phosphorus, and available potassium. Neither soil reaction nor contents of exchangeable calcium and magnesium were found to be statistically significant. The highest coefficient of multiple determination R = 0.588 was obtained in a regression including organic matter, silt and clay particles, and available phosphorus. A critical deficiency of phosphorus in soils of Bayfield Barrens, limiting the growth of jack pine, was an unexpected outcome of this survey.

The minimum levels of soil fertility for planting jack pine were established on the basis of the averages of the six least values of different characteristics, determined in soils supporting plantations with annual height growth of 14 or more inches. These averages have been appropriately reduced to express the fertility level that existed at the time of tree planting.

U. Wis., Madison, Wis., 53706

271. Loucks, D. P. THE DEVELOPMENT OF AN OPTIMAL PROGRAM FOR SUSTAINED-YIELD MANAGEMENT. J. Forestry 62(7): 485-490. 1964.

Two mathematical models were presented to aid foresters in developing sustained-yield cutting schedules. In the first model, the volume to be cut was maximized subject to the various conditions imposed by nature and required by the management plan. In the second model, the area to be cut was minimized while assuring a specified yield for each cutting period.

The solution of a hypothetical management problem was presented to illustrate the usefulness as well as the limitations of these models. Various management alternatives were considered and evaluated in terms of the increase or decrease in the total yield produced.

The information available from this type of analysis can aid in the development of better cutting schedules and in the evaluation of proposed management practices.

No address given.

272. Marquis, D. A., Bjorkbom, J. C., and Yelenosky, G. EFFECT OF SEEDBED CONDITION AND LIGHT EXPOSURE ON PAPER BIRCH REGENERATION. J. Forestry 62(12): 876-881. 1964.

The germination, survival, and first-year height growth of paper birch seedlings were studied in patch cuttings under different exposures to light on prepared seedspots representing three types of seedbed. Mineral soil was the best and humus was satisfactory under conditions of high rainfall, but leaf litter was poor under all field conditions tested. Shady locations were most favorable. High soil moisture and modest soil temperatures were associated with these environments.

Exposure to sunlight, and types of seedbed were important factors governing first-year height growth. Sunny locations were best; seedling height increased with increased light exposure. Growth was better on organic seedbeds than on mineral soil.

Northeastern Forest Expt. Sta., FS, USDA, Upper Darby, Pa., 19082

273. Clark, F. B., and Boyce, S. G. YELLOW-POPLAR SEED REMAINS VIABLE IN THE FOREST LITTER. J. Forestry 62(8): 564-567. 1964.

Yellow-poplar seed remained viable for four winters in forest litter in experimental areas in Illinois and Indiana. Under natural conditions, viable seed accumulates for several years and germinates when seedbed conditions are suitable. With proper cutting and a favorable seedbed, there is little need to reserve seed trees on areas cut to reproduce yellow-poplar.

Some basic information was given about the germination of yellow-poplar seed. Some seeds germinate in the forest litter without a mineral seedbed, but such seedlings rarely live more than one growing season. Sunadflat tests showed that stratification for one winter did not break dormancy in all seeds, but after stratification for two winters most of the seed germinated if conditions were favorable.

Central State Forest Expt. Sta., FS, USDA, Bedford, Ind., 47421

274. Miller. R. L., and Choate, G. A. THE FOREST RESOURCE OF COLORADO. U.S. Forest Serv. Resource B. Int-3, 54 pp. 1964.

This inventory of Colorado's 22.6 million acres of forest land showed 12.3 million acres of commercial forest with a volume of 52.7 billion board feet in sawtimber trees. Although timber use has almost quadrupled since 1935, Colorado's timber cut in relation to its inventory is the lowest of the Mountain States. Problems in managing and increasing the cut from the State's big area of old-growth forest were discussed. Other forest values—water, forage, and recreation—were also examined from the standpoint of trends in use and present and anticipated future importance to the State and Nation.

Photographs, tables, charts, and maps.

Rocky Mountain Forest and Range Expt. Sta., FS, USDA, Fort Collins, Colo., 80521

275. Manthy, R. S., and James, L. M. MARKETING PULPWOOD IN THE NORTH CENTRAL REGION. Mich. Agr. Expt. Sta. Res. B. 6 (North Central Reg. Res. P. 156) 120 pp. 1964.

A report was given on a regional project studying the following: (1) How effectively present marketing practices reflect wood-use demands backward to wood processors and timber producers, and producers' supplies forward to primary manufacturers or concentrators; (2) the costs and margins of moving forest products from the woods to primary manufacturers or concentrators; and (3) the changes in marketing practices which might raise marketing efficiencies and strengthen working relations among landowners, producers, processors, and market agents.

Cooperating states followed a uniform approach. Localized study areas were selected in each state. Standardized interview schedules were developed for use at each market stage considered in the study—producer, intermediate market agent, and primary manufacturer. Definitions and procedures, including sampling were standardized. Agreement was reached to obtain coverage of the following wood-products industries: Lumber; face veneer; container veneer; cooperage; wood pulp; posts; poles; and piling.

Mich. State U., Agr. Expt. Sta., East Lansing, Mich., 48823

276. Wheeland, H. A. BIBLIOGRAPHY OF TIMBER-PRODUCTS HARVESTING IN EASTERN UNITED STATES AND CANADA. U.S. Dept. Agr. Central State Forest Expt. Sta. Unnumbered Rpt. 27 pp. 1964.

A bibliography of 386 articles was given on timber-products harvesting in the eastern United States and Canada.

Central States Forest Expt. Sta., FS, USDA, Columbus, Ohio, 43215

277. Polk, R. B. CHRISTMAS TREES A MISSOURI CROP. Mo. Agr. Expt. Sta. B. 820, 40 pp. 1964.

An illustrated "culture, care, and marketing" publication was given on Christmas tree production in Missouri.

U. Mo., Col. Agr., Agr. Expt. Sta., Columbia, Mo., 65202

278. Stevens, T. D., and Lemmien, W. A. COMPARISON OF TWO STRAINS OF DOUGLAS-FIR FOR CHRISTMAS TREE PRODUCTION IN SOUTHWESTERN MICHIGAN. Mich. Agr. Expt. Sta. Q.B. 47(1): 86-94. 1964.

In 1952, Douglas-fir of two Rocky Mountain seed sources was planted on the Kellogg Forest in Kalamazoo County, Mich. The southwestern seed source was from the Deer Lodge National Forest, and the northwestern seed source was from the Kootenai National Forest, both in Montana.

Trees of the northwestern strain grew more rapidly than those of the southwestern strain. Survival of both strains was excellent. Each strain was injured by a late spring frost in 1955, but there was no statistically significant difference between the strains.

Doublas-fir of the northwestern strain was definitely superior to the southwestern in growth rate, Christmas tree production, and total cash value.

U. Mich., Agr. Expt. Sta., East Lansing, Mich., 48823

279. Starr, J. W. THE USE OF THE MIST BLOWER FOR CONTROL OF UNDESIRABLE HARDWOODS. Miss. Agr. Expt. Sta. B. 692, 15 pp. 1964.

The primary objective of mist blowing is the removal of dense stands of small undesirable hardwoods (up to 20 or 25 feet high) often found as understories in pine forest. This understory is difficult to control by aerial application because the overstory of pine or hardwood intercepts most of the spray. The mist blower offers a means of treating small blocks of isolated stands that could not be treated economically from the air. The treatment can be used to release already established pines that are being overtopped by undesirable hardwoods or can be used as site preparation for underplanting. It has a limitation insofar as natural regeneration is concerned in that it does little to prepare a seedbed and the resurge of hardwoods may come before the seedlings become established and obtain a favorable position.

From the tests at the Mississippi State University Experiment Station, the present recommendations are to apply from 1-1/2 to 2 pounds of acid equivalent per acre of 2,4,5-T in a total solution of 5 gallons. If pine release is the primary objective, then an oil-water emulsion of 10 percent oil by volume should be used. This oil percent should be increased as the growing season progresses or during long periods of prolonged drought. Where site preparation for planting is the objective, an oil carrier should be used.

With good control over the amount of solution applied per acre and extreme care to obtain complete coverage, acceptable results can be expected from mist blowing providing that the site and species composition are favorable. These results will range from 45 to 60 percent control of the hardwood brush. Pine damage in rlease work can be held at a minimum if an oil-water emulsion is used and a direct blast from the outlets can be avoided.

The mist blower is not a "cure-all" for all hardwood problems but is a tool and in most cases will have to be used in combination with other techniques.

Miss. State U., Agr. Expt. Sta., State College, Miss., 39762

280. Baron, F. J., Stark, N., and Schubert, G. H. EFFECTS OF SEASON AND RATE OF APPLICATION OF 2,4-D and 2,4,5-T ON PINE SEEDLINGS AND MOUNTAIN WHITETHORN IN CALIFORNIA. J. Forestry 62(7): 472-474. 1964.

Low volatile esters of 2,4-D or 2,4,5-T in a water carrier were applied to mature mountain whitethorn plants in intermingled, 10-year-old sugar pine reproduction at various times of the year and at different dosages.

The 2,4,5-T applications consistently caused more damage to the brush and less to the pines than did 2,4-D. Other factors affecting results were concentration of chemical and month of application.

From 80 to 100 percent of the brush stems were killed by single applications of 200 p.p.m. of 2,4,5-T in any month from May through September.

Sugar pine height growth exceeded that of the untreated controls after August or September applications of 2,4,5-T spray resulted in greater pine height growth than when the brush was removed mechanically.

Increasing the 2,4-D concentrations of the September spray to 600 p.p.m. killed only about half the brush and most of the pine leader growth. Application of 2,4,5-T at 100 p.p.m. resulted in pines growing more than did the controls, although brush kill was low, suggesting hormonal stimulation.

For broadcast applications of 2,4,5-T,brush kill increased from 20 to 100 percent as dosage was increased from 1/4 to 1 p.p.a. and exceeded that of the untreated controls, whereas the 2 p.p.a. rates reduced growth, and the 4 p.p.a. rate killed the new leaders. The poor brush kill at 1/4 p.p.a. again suggests a hormonal stimulation of pine growth or greater initial height.

Pacific Southwest Forest and Range Expt. Sta., FS, USDA, Berkeley, Calif., 94701

281. Boyer, W. D. LONGLEAF PINE SEED PREDATORS IN SOUTHWEST ALABAMA. J. Forestry 62(7): 481-484. 1964.

A 3-year study in southwest Alabama showed that predators caused 93 to 99 percent of the seed and seedling losses during the first 3 months after spot seeding in November. Predator pressure was about equal in forest stands, seed-tree stands, and clearcut areas except for 1 year when the seed crop was much better than the other 2 years. That year the losses in the stands were significantly lower than in the openings.

Small mammals were responsible for an average of 58 percent of the losses for all years; birds plus large mammals, 33 percent; and insects, chiefly ants, 9 percent. Losses to mice peaked before seeds germinated. Losses to birds and large mammals occurred before, during, and after germination. Losses to ants peaked during germination. Losses to all predators virtually ended when primary needles emerged.

Southern Forest Expt. Sta., FS, USDA, Brewton, Ala., 36429

Windbreaks

282. Dawson, D. H., and Read, R. A. GUIDE FOR SELECTING SUPERIOR TREES FOR SHELTERBELTS IN THE PRAIRIE PLAINS. U.S. Forest Res. Serv. Res. Paper LS-13, 22 pp. 1964.

Some of the important desirable characteristics in shelterbelt species were defined to provide a standard to aid in the selection of superior trees by field personnel interested in the tree improvement program.

Traits such as growth rate, crown density, width of crown, angle of branching, time of flushing and defoliation, straightness of stem and resistance to drought, winter injury, insect infestations, and disease were defined and illustrated.

Lake States Forest Expt. Sta., FS, USDA, St. Paul, Minn., 55101

283. Van Haverbeke, D. F. SHELTERBELT RESEARCH IN NEBRASKA. Nebr. Expt. Sta. Q. 9(2): 17-18. 1964.

It was estimated there are 338,415 acres, or 42,302 miles, of planted tree windbarriers in Nebraska. Last year alone, nearly 6,220 acres (776 miles) of new windbarriers were planted.

Most of these plantings are on or next to cultivated crop land and around farm buildings and livestock feeding areas. These shelterbelts need managing to maintain them as effective windbarriers.

Most existing shelterbelts dotting the Great Plains today were established during the "dust bowl" period of the 1930's and early 1940's. Field shelterbelts were generally 1/2 to 1 mile long, with from 3 to 20 rows of trees.

In the last 5 years, many narrower windbarriers have been established in fields to reduce surface wind velocity and erosion, and to decrease blowout and sandblasting of young crop plants. They also trap snow, conserve soil moisture, and thereby improve crop yields.

These narrower plantings, usually 1 to 3 rows, are planted either parallel at 20- to 30-rod intervals across the areas to be protected, or in a pattern system. The rows of trees are supplemented with such conservation practices as strip-cropping and stubble-mulching.

Studies in Nebraska showed that conifer species (eastern redcedar and ponderosa pine) responded to release from nearly 25 years' suppression by adjacent rows of Russian-olive and green ash trees.

A companion study showed that such deciduous species as Siberian elm, hackberry, green ash, American elm, and honeylocust also responded to release from intense crowding in many of the older shelterbelts.

Many older shelterbelts contain abundant natural reproduction, particularly eastern redcedar seedlings in rows formerly occupied by cottonwood.

Cultural methods for repairing damaged shelterbelts are being studied. They include mowing and various means of mechanical and chemical weed control.

U. Nebr. Col. Agr., Agr. Expt. Sta., Lincoln, Nebr., 68503

Fruit and Nut Crops

See Also 69, 98, 99, 100, 110, 115, 212, 213, 248.

284. Agricultural Research Service. GROWING PEACHES EAST OF THE ROCKY MOUNTAINS. U.S. Dept. Agr. Farm B. 2205, 24 pp. 1964.

A revised edition of a complete "culture and care" publication was given on growing peaches east of the Rocky Mountains.

Photographs.

ARS, USDA, Inform. Div., FCB, Hyattsville, Md., 20782

285. Westwood, M. N., Degman, E. S., and Grim, J. H. EFFECTS OF LONG-TERM FERTILIZER AND MANAGEMENT PRACTICES ON GROWTH AND YIELD OF PEARS GROWN IN A CLAY ADOBE SOIL. Oreg. Agr. Expt. Sta. Tech. B. 82, 39 pp. 1964.

Six tests of varying durations were carried out at the Southern Oregon Experiment Station between 1942-63, with Anjou, Bartlett, and Bosc pear trees growing in Meyer clay adobe soil.

The effects of mulching, nitrogen, and compacting experiments on Anjou pears were: (1) Tree growth, fruit set, and yield were generally greater with high rates of nitrogen, mulches, and non-compaction than with low nitrogen, no mulching, and soil compaction; (2) fruit size was not closely related to treatments but was inversely related to crop density; (3) soil moisture was lowest in compacted soil, intermediate in cultivated soil, and highest under mulches; (4) soil pH was lowered in proportion to the amount of $(NH_4)_2SO_4$ applied; and (5) soil nitrate increased as the rates of nitrogen were increased.

The effects of pruning experiments on Anjou pears were: (1) Fruit set and yield were greater with moderate or heavy pruning than with nonpruning; (2) shoot growth was greater with heavy than with moderate pruning, but yields were similar for both treatments; and (3) the stimulus of pruning on fruit set was not transferred to unpruned leaders of the same tree.

The effects of tree thinning on Anjou pears were: (1) There was an immediate increase in yield per tree after removal of half the trees (alternate diagonal rows), originally spaced 25 by 25 feet apart, but yield per acre was decreased; and (2) after 14 years, widely-spaced trees were larger than unthinned ones, but per-acre yield was still lower than on unthinned trees.

The effects of cultivation, cover crop, and sod experiments on Anjou pears were: (1) Tree growth was greatest with cultivation, intermediate with cover cropping (rye and vetch), and least with sod; (2) fruit set and yield were greater with cultivation than other cultures, but fruit size was similar in all treatments; (3) leaf nitrogen was highest with cultivation, intermediate with cover crop, and lowest with sod; (4) soil nitrate in the spring was lower in sod; (5) with 20 pounds $(NH_4)_2SO_4$ per tree annually, soil pH (to a depth of 3 feet) was slightly lower in cultivation than in other cultures; (6) both pH and yield were increased the second year after lime and nitrogen were applied to plots with low soil pH; and (7) soil moisture was highest in cultivation, intermediate in cover crop, and lowest in sod.

The effects of culture and nitrogen level on Bartlett and Bosc pears were: (1) Fruit set, yield, and size of Bartlett were highest with cultivation and lowest with mulch. Set and yield of Bosc were highest with mulch and lowest with sod. (2) Yield was highest for Bartlett with 1.5 pounds nitrogen (per tree annually), but 4-pounds nitrogen was best for Bosc. (3) The largest fruit for both varieties was from trees in cultivation getting 4 pounds nitrogen annually. (4) Longest shoot growth occurred for both varieties at the higher levels of nitrogen plus cultivation. (5) Leaf nitrogen varied directly with the amount of nitrogen applied. Bosc leaves contained about 0.3 percent less nitrogen than did Bartlett leaves. (6) Soil nitrate in May and June was directly related to the amount of nitrogen applied. By June 19, sod contained only half as much nitrate as other cultures. (7) Soil pH varied inversely with the amount of $(NH_4)_2SO_4$ applied, and was lower in cultivation than in other cultures. And (8) soil moisture was slightly higher in cultivation than in other cultures, but all appeared to be adequate.

The effects of pruning experiments on Bartlett and Bosc pears were: (1) Both Bartlett and Bosc yielded more fruit with no pruning than with pruning; and (2) maximum yield of fruits larger than 2-3/8 inches diameter was attained by light pruning of Bartlett and by heavy pruning of Bosc (with no hand thinning).

Tables and graphs.

Agr. Expt. Sta., Oreg. State U., Corvallis, Oreg., 97331

286. Sirois, D. L., and Cooper, G. R. THE INFLUENCE OF LIGHT INTENSITY, TEMPERATURE AND ATMOSPHERIC CARBON DIOXIDE CONCENTRATION ON THE RATE OF APPARENT PHOTOSYNTHESIS OF A MATURE APPLE TREE. Maine Agr. Expt. Sta. B. 626, 36 pp. 1964.

Multiple regression analyses of data obtained by measurements of the assimilation rate and certain environmental factors showed that light intensity was the most important factor influencing the rate of apparent photosynthesis, accounting for 67.60 percent of the variation in the assimilation rate. Atmospheric carbon dioxide concentration was a second important factor, which accounted for an additional 26.23 percent reduction in the unexplained variation in CO_2 assimilation, while temperature was not a significant estimator of the assimilation rate.

Evidence indicates that the relationship of the rate of photosynthesis to light intensity may be a curve of approximately logarithmic form, the effects of light intensity being less as the level of light intensity increased. At high light intensity, CO_2 concentration was a more significant estimator of the CO_2 assimilation rate than light intensity.

These regression studies demonstrate that a mathematical equation can be derived which represents the relationship of CO_2 assimilation to the combined effects of light intensity and CO_2 concentration. This equation is:

$$Y = -3.31616 + 0.005811\ (X_1X_3)$$

where (X_1) is light intensity and (X_3) is CO_2 concentration. This suggests that no single factor controls the rate of photosynthesis but that it is determined by the interaction of individual factors.

Maine Agr. Expt. Sta., U. Maine, Orono, Maine, 04473

287. Sirois, D. L., Hilborn, M. T., and Cooper, G. R. INFLUENCE OF CERTAIN FUNGICIDES ON APPARENT PHOTOSYNTHESIS OF AN ENTIRE APPLE TREE. Maine Agr. Expt. Sta. B. 629, 18 pp. 1964.

A mature apple tree was enclosed within an inflated plastic air-house, and the rate of carbon dioxide assimilation was measured by infra-red gas analysis. After spraying the test tree with a given fungicide, the CO_2 assimilation rate was measured, along with measurements of light intensity and atmospheric CO_2 concentration. By substituting these values in a regression equation, a predicted value for the assimilation rate was obtained. A comparison of the predicted rate with the actual rate enabled the actual rate to be expressed as percent.

Results indicated that the organic fungicides Niacide M and glyodin and inorganic sulphur fungicides reduce the rate of CO_2 assimilation of an entire apple tree. Reduction due to the sulphur fungicides persisted much longer than that due to the organic fungicides. After an initial suppression period, the rate of assimilation of the tree, when sprayed with elemental sulphur compounds, returned to the rate achieved prior to spraying. After a brief suppression period, both Niacide M and glyodin sprays resulted in assimilation rates higher than the original rate present before spraying, with glyodin causing the greatest increase.

The data suggest that the increased yields of trees sprayed with organic fungicides in comparison with those sprayed with elemental sulphur fungicides may be due to: A greater detrimental effect on assimilation by the sulphur fungicides; a stimulatory effect of the organic fungicides on assimilation; or to a combined effect of both factors.

Maine Agr. Expt. Sta., U. Maine, Orono, Maine, 04473

288. Cutright, C. R. THE CODLING MOTH IN OHIO: HISTORICAL AND ECOLOGICAL ASPECTS. Ohio Agr. Expt. Sta. Res. B. 969, 48 pp. 1964.

From a review of the Ohio horticultural and entomological literature and from personal experiences of entomologists who have worked with the codling moth during the last 40 years, the following conclusions were drawn:

1. The codling moth was introduced into Ohio as larvae in infested fruit or as cocooning larvae in boxes or baskets.
2. The date of first codling moth injury in Ohio is not known. Apparently it was observed in the 1830's or early 1840's.
3. Many small and isolated orchards remained relatively free from codling moth injury until the early 1890's.
4. Codling moth injury has influenced commercial apple production and has been one of the factors that caused the abandonment of the industry in some areas.
5. The decline and disappearance of the farm orchard was due to increased ravages of insects and diseases. The codling moth was a definite factor in this decline.
6. The correct interpretation of ecological data as related to the codling moth necessitates an accurate knowledge of its life history.
7. Among the ecological factors, seasonal temperatures are very important in the rate of development of codling moth infestations.
8. Other climatic factors such as humidity, rainfall, and wind play a part.
9. Natural enemies, including predators, parasites, and diseases, may at times be effective but generally are of little importance.
10. Orchard management is important. This includes such practices as spraying, pruning, sanitation, and harvesting.
11. Successful control of the codling moth is a product of: (1) An efficent spray program; (2) climatic conditions unfavorable to the insect; (3) good orchard management; and (4) low initial codling moth population.
12. An efficient spray program is the most important of all factors for successful control.

Ohio Agr. Expt. Sta., Wooster, Ohio, 43210

289. Kilgore, W. W., Yates, W. E., and Ogawa, J. M. EVALUATION OF CONCENTRATE AND DILUTE GROUND AIR-CARRIER AND AIRCRAFT SPRAY COVERAGE. Hilgardia 35(19): 527-536. 1964.

A 2-year study was conducted to determine the extent of disease control (Coryneum blight and Hendersonia leaf blight) and coverage efficiency of low-volume (concentrate) sprays of captan applied to almond trees at petal-fall and 1 week after petal-fall stage of bloom. Results were compared with data obtained by the standard high-volume ground spraying technique. Three methods of concentrate spray applications were used: The fixed-wing aircraft method; the helicopter aircraft method; and the low-volume ground method. Studies of the three methods of concentrate spray applications compared to the standard high-volume ground applications produced the following results:

1. The microscope slide technique proved to be an excellent measure of the spray coverage for each of the methods tested when compared to disease performance data and captan desposits on leaves.
2. With each method tested, deposits on the slides placed in the upper levels of the trees were approximately the same as those placed in the lower levels.

3. Spray coverages resulting from high-volume and low-volume ground applications produced large deposits on both the upper and lower surfaces of the microscope slides.
4. Spray coverage resulting from the fixed-wing aircraft method indicated that large deposits were on the upper surfaces of the slides, but that only trace amounts were present on the lower surfaces.
5. Spray coverage resulting from the helicopter aircraft method indicated that large deposits were on the upper surface of the slides, and that more deposits were on the lower surfaces, compared to the fixed-wing aircraft method.
6. The low- and high-volume ground spray applications gave equal control of Coryneum blight and Hendersonia leaf blight. Although the incidence of disease was considerably lower than in the untreated check, the fixed-wing aircraft application gave no significant control of Hendersonia leaf blight. It did show, however, some control of Coryneum blight. The helicopter application could not be evaluated for disease control because of the low incidence of the two leaf diseases in 1962.

Agr. Pub., University Hall, U. Calif., Berkeley, Calif., 94720

290. Kilby, W. W., Shear, C. B., and Van Der Zwet, T. THE CULTIVATION OF TUNG: FOR ECONOMIC PRODUCTION: LEAF SPOT REDUCTION: AND SPRING FROST PROTECTION. Miss. Agr. Expt. Sta. B. 696, 15 pp. 1964.

Soil type, orchard site, tree variety, planting distance, fertilization, and schedule of orchard management operations are all important considerations in the successful production of tung. No other single factor, however, affects growth, yield, and the general well-being of the tung tree as much as cultivation.

Cultivation has three main purposes: To change the structure of the soil; to control weeds; and to manage crop residues. These effects of cultivation have many ramifications which influence many aspects of tung production. The effects of cultivation on growth and production of trees and the relation of cutlivation to the development of the angular leaf-spot disease and to spring frost injury were reported.

Photographs.

Miss. State U., Agr. Expt. Sta., State College, Miss., 39762

Field Crops

See Also 34, 35, 36, 37, 39, 41, 55, 56, 67, 89, 100, 109, 111, 113, 114, 118, 119, 120, 122, 125, 126, 150, 168, 170, 171, 172, 174, 177, 179, 194, 199, 210, 213, 228, 235, 249, 250, 313, 317, 347, 350, 370.

291. Tackett, J. L., and Pearson, R. W. OXYGEN REQUIREMENTS OF COTTON SEEDLING ROOTS FOR PENETRATION OF COMPACTED SOIL CORES. Soil Sci. Soc. Amer. Proc. 28(5): 600-605. 1964.

Cotton root growth and activity were determined at different levels of subsoil bulk density and O_2 concentration. Subsoil cores of desired bulk density were aerated, leaving both the soil moisture content intact and the surface soil exposed to diffusion of gases from the atmosphere. Measurements of root growth and activity in the subsoils included depth of root penetration, root yield, water uptake, and carbon dioxide production in the subsoil.

Mechanical impedance was more detrimental than low O_2 for root growth in the subsoils at bulk densities above 1.5 g. cm.$^{-3}$. At lower densities, root growth was depressed at O_2 levels below 10 percent and there was a strong interaction of O_2 and bulk density.

SWCRD, ARS, USDA, Temple, Tex., 76502

292. Schrenk, W. F. MINERALS IN WHEAT GRAIN. Kans. Agr. Expt. Sta. Tech. B. 136, 23 pp. 1964.

A review of the literature was given on the minerals in wheat grain, their function in the plant, and methods to determine the amount of minerals in wheat grains.

Tables and bibliography.

Agr. Expt. Sta., Kans State U., Manhattan, Kans., 66504

293. Benne, E. J., Linden, E., Grier, J. D., and Spike, K. COMPOSITION OF CORN PLANTS AT DIFFERENT STAGES OF GROWTH AND PER-ACRE ACCUMULATIONS OF ESSENTIAL NUTRIENTS. Mich. Agr. Expt. Sta. Q.B. 47(1): 69-85. 1964.

The amount of the various elements removed in a corn crop by the different methods of harvesting was given.

Tables.

Mich. State U., Agr. Expt. Sta., East Lansing, Mich., 48823

294. Weibel, R. O., and Pendleton, J. W. EFFECT OF ARTIFICIAL LODGING ON WINTER WHEAT GRAIN YIELD AND QUALITY. Agron. J. 56(5): 487-488. 1964.

A 3-year artificial lodging study with winter wheat was conducted at Urbana, Ill. Lodging resulted in a great decrease in yield, test weight, and kernel weight. These detrimental effects were more severe when lodging was imposed at the heading stage than at any stage thereafter. When compared to erect plants, reduction in yield due to lodging at heading, milk stage, soft-dough stage, and hard-dough stage was 31, 25, 20, and 12 percent, respectively. The grain from lodged plants was higher in protein than grain from erect plants. The lodging data collected supported the strong emphasis placed on straw strength in present winter wheat breeding programs. These findings also suggest that differential lodging is often the reason for significant variety X year or variety X location interactions encountered in wheat variety trials.

Ill. Agr. Expt. Sta., Urbana, Ill., 61803

295. Tavernetti, J. R., and Carter, L. MECHANIZATION OF COTTON PRODUCTION. Calif. Agr. Expt. Sta. B. 804, 25 pp. 1964.

Since 1948, there has been a revolution in the methods of growing and harvesting cotton, California's leading cash crop. In that year, a cooperative project was organized to study various phases of mechanizing cotton production. This work included:

The constructing and testing of new equipment; improving equipment already in use; and experimenting with various cultural practices. By 1962, mechanical pickers were used for 90 percent of the cotton harvesting in California, compared to 10 percent in 1948. Other hand labor in cotton growing had also been greatly reduced.

The mechanization studies were described and their results were summarized.

Tables and photographs.

Calif. Agr. Expt. Sta., U. Calif., Davis, Calif., 95616

296. Kirk, I. W., Wanjura, D. F., and Hudspeth, E. B., Jr. TRACTOR-MOUNTED BASKETS SAVE LABOR IN STRIPPER HARVESTING. Tex. Agr. Expt. Sta. Prog. Rpt. 2316, 3 pp. 1964.

Farmers have begun to use tractor-mounted baskets instead of drawn trailers with cotton-stripper harvesters to reduce labor requirements for the harvesting operation. Time and labor requirements for harvesting with a stripper-tractor-mounted basket system and a stripper-tractor drawn trailer system were evaluated at Lubbock, Tex., in 1963. Labor used for loading the trailer may be reduced or eliminated through the use of a tractor-mounted basket system. The average labor requirement for harvesting a bale of cotton with the basket system was 40 percent lower than for the conventional drawn trailer system. Even though the time available for harvesting was spent in different activities with each system, the percent of the total time spent actually harvesting was approximately the same. The tractor-mounted basket system will permit harvesting as much cotton as with a conventional stripper trailer system and at a lower labor requirement, thus reducing the cost of stripper harvesting.

Tex. A&M U., Tex. Agr. Expt. Sta., College Station, Tex., 77841

297. Tso, T. C., Engelhaupt, M. E., and Sorokin, T. P. CHEMICAL CHANGES ASSOCIATED WITH TOBACCO FRENCHING. Tobacco Sci. 8: 154-157. 1964.

Frenching is a noninfectious physiological disorder which usually appears as a network chlorosis of apical leaves followed by formation of progressively narrower leaves, and in extreme cases, by leaf stripping and natural decapitation.

Chemical investigation of tobacco plants (Nicotiana tabacum L. cv. Connecticut Broadleaf and 402) with different degrees of the frenching symptom revealed marked changes in organic composition. Alkaloids, organic acids, sugars, and amino acids from ethanol extracts and hydrolyzed fractions were studied. Among the most significant changes was the parallel increase of asparagine and citrulline. The changes in the amount of isoleucine, threonine, and valine, as well as the advance in the severity of the frenching symptom relating to a possible chemical feedback mechanism in the tobacco plant were discussed.

CRD, ARS, USDA, Beltsville, Md., 20705

298. Southwick, R. A., and Colby, W. G. PROCESSING OF MACHINE-HARVESTED STALK TOBACCO. Mass. Agr. Expt. Sta. B. 542, 16 pp. 1964.

With very few modifications, the tobacco harvest can be mechanized with already existing forage-harvesting machinery. The dehydrated tobacco can be fermented along similar patterns as those presently in use by manufacturers. The tobacco chemically resembles tobacco in the very early curing stages. Properly fermented, the finished tobacco cannot be distinguished from conventionally handled tobacco in manufactured products. The principal limiting factor in the acceptance of the mechanization of the tobacco harvest with forage machinery and subsequent dehydration is the lack of knowledge about the fermentation pattern which will develop the most desirable characteristics in the finished product.

Although this investigation was directed principally toward on-the-farm dehydrating operations, custom operations could be handled with already developed equipment similar to the stock wool dryer used for vat-dyed wool stock or other such drying equipment.

Expt. Sta., Col. Agr., U. Mass., Amherst, Mass., 01003

299. Spurgeon, W. I. FLOODING OF SHARKEY CLAY STUDIED: WINTER FLOODING INCREASED COTTON YIELDS BUT DOES NOT APPEAR PRACTICAL BECAUSE OF COST. Miss. Farm Res. 27(9): 6. 1964.

A Sharkey clay soil was maintained in flooded condition during the winter months for a 3-year period. Soil samples were made before and during flood and at different time intervals after drainage. Cotton was planted on the soil which had been flooded without seedbed preparation. Cotton was planted on the unflooded soil in the conventional manner. The effects of water flooding were:

1. During the flooded period, the soil ammonium nitrogen increased from 15 to 55 pounds per acre. Nitrate nitrogen decreased and was not detectable. The nitrification rate of the flooded soil was twice that of the unflooded soil. The soil pH increased from 6.3 to 6.6. Available P_2O_5 decreased slightly. Exchangeable K_2O and organic matter were not affected by flooding.
2. Winter flooding prevented winter weed growth and was effective in control of Johnsongrass from rhizomes. Rapid cottonseed germination and early plant growth were obtained without any seedbed preparation.
3. After drainage, the soil pH and ammonium nitrogen decreased and nitrate nitrogen increased. Nitrate nitrogen remained higher in the flooded than in the unflooded soil for 12 weeks after drainage.

For the 3-year average, the flooded soils produced 150 pounds of seed cotton per acre more than the unflooded soil.

Miss. State U., Agr. Expt. Sta., State College, Miss., 39762

300. Stickler, F. C., and Pauli, A. W. YIELD AND WINTER SURVIVAL OF WINTER BARLEY VARIETIES AS AFFECTED BY DATE AND RATE OF PLANTING. Crop Sci. 4(5): 487-489. 1964.

Results were reported of field experiments involving Dicktoo (relatively hardy), Reno (moderately hardy), and Rogers (relatively nonhardy) winter barley seeded at three rates on each of five dates from September 1 to November 1 from 1961-63 at Manhattan, Kans.

Although the level of winterhardiness obtained was slightly higher from October 15 than from October 1 plantings, highest yields were from planting October 1. Varieties responded similarly to date of planting. Date of planting at Manhattan, Kans., appeared to be more critical with winter barley than with winter wheat. The yield component, heads per unit area, was closely associated with yield over different dates of planting.

Reno and Dicktoo responded differently to seeding rate, with Dicktoo being quite responsive and Reno almost nonresponsive. Dicktoo apparently has greater ability to maintain numbers of seeds per head as stand density increases.

Agr. Expt. Sta., Kans. State U., Manhattan, Kans., 66504

301. Finley, L., Oliver, A. D., and Sloane, L. W. EFFECTS OF PLANTING DATE, TIME OF FRUITING, AND USE OF INSECTICIDES ON YIELD AND FIBER QUALITY OF COTTON. La. Agr. Expt. Sta. B. 584, 12 pp. 1964.

Cotton planted in Louisiana on May 15-16 produced fiber of higher quality than cotton planted on April 15-16 or May 1-2. In 1959, the yield of Stoneville 3202 cotton was the same, regardless of planting date. In 1960, Stardel cotton planted May 15-16 produced more seed cotton than that planted April 15-16 or May 1-2. Cotton planted May 1-2 produced more seed cotton than that planted on April 15-16.

Fiber quality of Coker 100 WR cotton planted in 1956 was the same when produced from plants deflorated 0, 3, and 7 weeks after fruiting began. In 1958, Stardel cotton deflorated for 7 weeks after fruiting began produced fiber significantly lower in length and fineness than that deflorated for 0 and 3 weeks. In 1959, Stoneville 3202 cotton fiber was equal in quality when deflorated for 0 and 3 weeks after fruiting began, but plants deflorated 7 weeks produced fiber significantly higher in strength and lower in fineness. Deltapine 15 cotton was significantly lower in fineness for plants deflorated 7 weeks while fiber length and strength were not affected by defloration of plants.

In 1960, Stardel cotton fiber length and nonlint content were not affected by defloration treatment. Strength of fiber was significantly higher from plants which were deflorated for 4 and 5 weeks after fruiting began. Significant differences occurred for fiber fineness and elongation where plants were deflorated 7 consecutive weeks.

In 1956, the Coker 100 WR variety yielded the same amount of seed cotton in treatments with no fruit removed as in those with fruit removed for 3 and 7 weeks after fruiting began. In 1958, Stardel cotton deflorated for 3 weeks after fruiting began yielding significantly more seed cotton than that not deflorated at all. In 1959, Stoneville 3202 and Deltapine 15 cotton not deflorated and that deflorated 3 weeks after fruiting began yielded significantly more seed cotton than that deflorated for 7 weeks. In 1960, Stardel cotton deflorated 1 to 7 weeks after fruiting began yielded significantly more cotton than that which was allowed to retain all fruit possible. Plants deflorated 4 and 5 weeks after fruiting yielded the greatest amount.

In 1959, there was a difference in yield of seed cotton where insect control was accomplished as compared to no control. In 1960, no insect control and the application of toxaphene-DDT (2 pounds + 1 pound per acre) beginning when 25 percent of the squares were punctured yielded less seed cotton than all other insecticide treatments.

La. State U. and Agr. and Mech. Col., Agr. Expt. Sta., University Station, La., 70803

302. Palmer, R. D., and Broadhead, D. M. WEED CONTROL IN SUGARCANE. Miss. Farm Res. 27(9): 7. 1964.

Studies were undertaken to test the effectiveness of diuron, simazine, and atrazine, as pre-emergence treatments in rotation as a post-emergence (lay by) treatment for all season weed control in plant cane and first-year stubble sugarcane. Dalapon plus 2,4-D was also used as a lay by treatment where simazine and diuron were used as pre-emergence treatments.

The best chemical rotation was diuron pre-emergence plus simazine lay by on the same plots where annual weeds were a problem. This treatment provided: Excellent weed control; higher cane yields; better juice quality; and higher syrup yields than did hoed and cultivated plots.

A surfactant aided the herbicidal properties of diuron, atrazine, and simazine as a post-emergence spray. Simazine or diuron as pre-emergence treatments followed by dalapon plus 2,4-D lay by gave perfect weed control in sugarcane. The lay by treatment was especially effective in controlling crabgrass and broadleaf weeds which escaped the pre-emergence treatment, as well as giving excellent pre-emergence control as a lay by treatment.

The usefulness of the chemical treatments depended upon the particular weed problem and the cultivation practices of the sugarcane.

Miss State U., Agr. Expt. Sta., State College, Miss., 39762

303. Hacskaylo, J., Walker, J. K., Jr., and Pires, E. G. RESPONSE OF COTTON SEEDLINGS TO COMBINATIONS OF PREEMERGENCE HERBICIDES AND SYSTEMIC INSECTICIDES. Weeds 12(4): 288-291. 1964.

Greenhouse experiments showed that monuron uniformly applied to the soil surface immediately after planting, was about twice as toxic to seedling cotton as was diuron. Phytotoxicity was increased when either of these herbicides was applied with either of the systemic insecticides phorate, or Di-syston.

CRD, ARS, USDA, Tex. A&M U., College Station, Tex., 77841

304. Dunn, H. A. COTTON BOLL WEEVIL (ANTHONOMUS GRANDIS BOH.) ABSTRACTS OF RESEARCH PUBLICATIONS, 1843-1960. U.S. Dept. Agr., Coop. State Res. Serv. Misc. P. 985, 194 pp. $1.00. 1964.

The cotton boll weevil is the most costly insect in the history of American Agriculture. It is often referred to as the $10 billion insect.

This publication was assembled to provide researchers with quick reference to accomplishments in research on the cotton boll weevil and to related information published prior to 1961. Researchers are urged to use it only as a reference guide, and to refer subsequently to the orginal publication or report.

Abstracts in each major section were arranged chronologically by year of appearance in print. Authors' names were arranged alphabetically within each year.

An author index was included.

For sale, Supt. Doc., U.S. Govt. Print. Off., Washington, D.C., 20402

305. Cooke, F. T., Jr., and Heagler, A. M. AN ECONOMIC APPRAISAL OF SKIP-ROW COTTON PLANTING. Miss. Agr. Expt. Sta. B. 697, 16 pp. 1964.

On better producing soils, skip-row planting systems commonly used on Delta farms have an income potential greater than that of a similar amount of allotted cotton planted solid with soybeans on the remaining land, if considered in light of current cotton-soybean price relationships.

The soil resource situation on any single farm materially affects the skip-row pattern used. If sufficient acreages of suitable soils are available, all cotton should be planted 2 × 2. As suitable soils become more restricted, a combination of 2 × 2 and 2 × 1 or 2 × 1 alone should be used, depending on the situation.

The 4 × 4 planting system, on sandy soils, was slightly more profitable than 2 × 1 on sandy soils, but 4 × 4 requires more land to produce an acre of cotton. Since sandy soils are limited on most Delta farms, 2 × 1 usually fits better into the farm organization.

Production costs associated with skip-row cotton were considerably higher than those of solid cotton.

All skip-row planting systems, other than 4 × 4, materially reduced equipment efficiency in peak demand periods. Management and equipment were under tremendous pressure during critical periods, such as planting and the application of post-emergence herbicides.

When yield responses of 10 to 20 percent below the average reported for skip-row planting occur, a greater farm income could be derived by planting solid cotton and soybeans, with current price relationships.

Tables.

Miss. State U., Agr. Expt. Sta., State College, Miss., 39762

Vegetable Crops

See Also 30, 100, 113, 114, 151, 173, 213.

306. Kehr, A. E., Akeley, R. V., and Houghland, G. V. C. COMMERCIAL POTATO PRODUCTION. Agr. Hbk. 267, 59 pp. 1964.

A complete "culture and care" publication was given on commercial potato production.

ARS, USDA, Inform. Div., FCB, Hyattsville, Md., 20781

307. Jaworski, C. A., and Hanna, W. J. SOIL TEST CALIBRATION WITH IRISH POTATO YIELDS. Soil Sci. 98(4): 227-234. 1964.

Two field experiments with Katahdin potatoes were conducted in 1959-60 on a Coastal-Plain-Piedmont transition soil to determine the response of this crop to varying levels of phosphorus and potassium from residual and fertilizer sources. The critical potassium level for response was found to approach 225 pounds per acre. At the highest nitrogen application, the relationship between potassium and yield was logarithmic. An analysis of variance indicated that potato yields did not vary with the levels of nitrogen or phosphorus or with nutrient interactions, except for a yield increase with the higher nitrogen in one of the years.

Multiple linear regression analyses were performed to correlate the potato yield variation with several methods of phosphorus extraction. Only Bray's No. 1 and Bray's No. 2 method of phosphorus extraction gave results that were correlated with potato yield variation. The electrodialysis method had the largest relative range between the highest and lowest amounts of phosphorus extracted.

The amounts of phosphorus and potassium added and the amounts of phosphorus and potassium as determined by an electrodialysis soil test, were used together in other multiple regression analyses with yields. With one exception, the logarithms of the potassium content of the leaves, or the logarithm or actual units of potassium ($K_{test} + K_{added}/2$) were the only independent variables related to potato yields. The exception was the logarithm of the phosphorus extracted by electrodialysis.

A highly linear relationship was shown between the potassium content of the leaves and the soil and fertilizer potassium values. Phosphorus content of the leaves did not vary with the soil and fertilizer phosphorus values but did decrease with increasing potassium values.

Rutgers—The State U., New Brunswick, N.J., 08903

308. Vaughan, E. K., Cropsey, M. G., and Hoffman, E. N. EFFECTS OF FIELD-CURING PRACTICES, ARTIFICIAL DRYING, AND OTHER FACTORS IN THE CONTROL OF NECK ROT IN STORED ONIONS. Oreg. Agr. Expt. Sta. Tech. B. 77, 22 pp. 1964.

Neck rot, caused by the fungus *Botrytis allii* Munn, occurs commonly wherever onions are grown commercially and is one of the most destructive diseases affecting the bulbs in storage.

Practices that reduced the incidence of onion neck rot and minimized losses caused by the disease during storage were:

1. Careful handling to avoid bruising.
2. Curing in the field for at least 5 days, preferably in wooden crates or bulk pallets that provide optimum conditions for drying of the necks and outer scales.
3. Artificial curing. Under eastern Oregon conditions, supplemental heat is required only when low temperatures, rainfall, or high humidity prevail during the harvest season. Shrinkage losses and neck rot losses were small in onions cured artifically. Warning: Artificial drying temperatures in excess of 125° F. for 24 hours, or 115° F. for 48 hours, caused serious injury and severe losses during storage.

Practices that increased incidence of neck rot during storage were: (1) Bruising during lifting, curing, and storing the onions; and (2) failure to cure onions before placing them in storage.

Application of extra potash fertilizer at midseason had no apparent effect on incidence of rot during storage.

Application of extra nitrogen fertilizer and extra irrigation water had no apparent direct effect on incidence of rot during storage. These practices did result in larger onions having large, succulent necks. Such onions are difficult to cure and were most susceptible to neck rot.

Tables and graphs.

Agr. Expt. Sta., Oreg. State U., Corvallis, Oreg., 97331

309. Newton, W. H., Deer, J. A., Hamman, P. J., Wolfenbarger, D. A., Harding, J. A., and Schuster, M. F. INSECTS ATTACKING VEGETABLE CROPS. Tex. Agr. Expt. Sta. B. B-1019, 27 pp. 1964.

The control of insects that attack vegetables assumes more importance than for most other crops because even monor damage may lower the vegetable crop's value or render it unfit for sale. Commercial vegetable growers should recognize the different insects in their various growth stages in order to begin control measures before damage occurs.

The insect pests presented were the most common ones encountered in the State's vegetable industry. However, some insects attack more and different vegetable crops than those listed here.

Beneficial insects often are found on vegetables, but seldom are abundant enough to keep destructive insects below damaging levels.

Specific control measures for individual pests were not included.

Tex. Agr. Ext. Serv., Tex. A&M U., College Station, Tex., 77841

ECONOMIC AND SOCIAL ASPECTS OF SOIL AND WATER CONSERVATION

Costs and Returns

See Also 3, 4, 5, 8, 31, 40, 41, 145, 158, 159, 192, 236, 237, 257, 261, 275, 290, 310, 321, 323, 324, 332, 338.

310. Swanson, E. R., and Harshbarger, C. E. EFFECTS OF SOIL LOSS ON CROP YIELDS. J. Soil and Water Conserv. 19(5): 183-186. 1964.

An economic analysis of effects of soil loss on crop yields was made on Swygert soils on 4 and 6 percent slope in northeastern Illinois under various rotations. The adoption of a cropping system and investment in conservation practices to limit soil loss to 3 tons per acre would result in some sacrifice of income over continuous corn. No attempt was made to assess the importance, as an obstacle to adoption of soil conservation plans, of the calculated income losses that would be incurred by adopting a land-use plan that meets the recommended soil loss tolerance. Such sacrifices of income were quite small when considered on an annual basis. Other aspects of the effects of soil loss, such as damage attributable to sediment deposition in waterways, were not taken into consideration.

Conclusions based on these findings do, however, conflict with the prevailing belief that "soil conservation pays" for the individual farmer. This does not mean that it is not in the best interests of society to keep annual soil losses on Swygert soils at 3 tons or less per acre. The results simply indicate that if the relationship between soil loss and crop yield is studied in isolation from changes in technique of production, a farmer on Swygert soils would sacrifice income by keeping soil losses at or below the recommended level.

U. Ill., Urbana, Ill., 61803

311. Krenz, R. D. PLANNING PRODUCTION WITH VOLUNTARY DIVERSION PROGRAMS. N. Dak. Agr. Expt. Sta. B. 449, 16 pp. 1964.

In the 1962-63 crop years, various crop diversion options were included in the government farm programs for wheat and barley, and they may be included in future programs. These options permit farmers voluntarily to divert wheat and barley acres to conserving uses for additional payments. The options are intended to give the farmer more freedom in decision-making and at the same time control supply, reduce storage costs, and maintain farm income.

Some of the factors were examined which must be considered by farmers in north-central North Dakota indeciding to divert or not to divert cropland under voluntary diversion programs. The analysis assumes that farmers will participate in the wheat and barley programs at the minimum level to qualify for support prices. The question to be answered is how much additional diversion, if any, will maximize profits.

Tables.

Agr. Expt. Sta., N. Dak. State U., Fargo, N. Dak., 58103

312. Nohre, C. O., and Jensen, H. R. PROFITABLE FARM ADJUSTMENTS IN SOUTH-CENTRAL MINNESOTA. U. Minn., Agr. Expt. Sta. B. 471, 48 pp. 1964.

Some general guidelines for farm reorganization were suggested from the study. Farmers in south-central Minnesota might consider the following points in planning their future operations:

1. Larger farms provided an opportunity for greater incomes, particularly when larger acreages were combined with a larger supply of capital.
2. The present combination of enterprises should not rule out consideration of alternative farm plans if future price projections appear favorable.
3. Unless a grade A market was available, dairying was not a promising alternative except when beef and hog prices were at or near the low levels considered.
4. Type of farm had but minor effect on the adjustment of current farm organizations to profit-maximizing plans.
5. Size of farm had but little effect on the kind of adjustment required to change from current to optimal organizations.
6. The main effect of varying corn prices concerned business volume. Livestock volume tended to increase with low corn prices and decrease with high corn prices. At low corn prices, beef feeding was included in the farm organization on the medium Cash Grain and on the medium and small dairy farms.
7. In organizing farms for maximum profit, managers must consider how to adjust to high beef prices.
8. Varying hog prices result in much more income variation than do varying beef prices.
9. Purchase of additional land appears to be an income-improving adjustment for nearly all farms. But credit capital requirements for purchasing additional land and for making other changes that maximize income are higher.

U. Minn., Agr. Expt. Sta., St. Paul, Minn., 55101

313. Brints, N., and White, J. H. CROP ENTERPRISES ON COTTON FARMS IN NORTHEAST ARKANSAS: PRODUCTION REQUIREMENTS, ESTIMATED COSTS, AND RETURNS. Ark. Agr. Expt. Sta. Rpt. Series 131, 70 pp. 1964.

Adjustments in farm organization and resource use frequently are needed to meet changes in institutional, technological, and economic conditions. A farmer must be aware of new developments affecting resource requirements, yields, and product and factor prices in order to choose the most profitable alternative use of resources.

Input-output budgets for crops based on the use of advanced techniques of production on owner-operated farms in northeastern Arkansas were presented for the loessial terrace and bottom land soil associations.

This publication should help provide basic data necessary for developing and evaluating alternative farm plans in an effort to maximize returns to owned resources.

Map and 117 tables.

Agr. Expt. Sta., U. Ark., Fayetteville, Ark., 72701

314. Heady, E. O., and Butcher, W. R. EFFECT OF FEED-GRAIN OUTPUT CONTROLS ON RESOURCE USES AND VALUES IN NORTHERN AND SOUTHERN IOWA. Iowa Agr. Expt. Sta. B. 531, 267-300. 1964.

Per capita incomes of persons employed in agriculture have been declining relative to incomes of persons in the remainder of the economy. Efforts to increase farmers' incomes through supported product prices created a need for measures that will effectively control production and prevent the accumulation of surplus stocks. The potential effects of a particular type of production control—direct control over the output of feed concentrates—were studied.

Representative farms were selected for analysis from two Iowa areas—an eight-county area in the south-central Iowa Corn Belt fringe area, and a seven-county area in the northern Iowa central Corn Belt cash-grain area. A survey of 222 farmers provided basic data for constructing linear programming models to portray the planning environment of selected representative farms.

Linear programming models of representative farms were formulated assuming: (1) Average technologies and rates of efficiency in production processes; (2) a shortrun planning situation in which land, labor, and machinery investments are fixed; and (3) profit maximization as the goal to which production is directed. The effect of output control was estimated by comparing profit-maximizing production plans without output control with plans where output of feed concentrates was controlled.

Tables.

Agr. and Home Econ. Expt. Sta., Iowa State U. Sci. and Tech., Ames, Iowa, 50010

315. Moore, E. J. THE LOW INCOME PROBLEMS IN AGRICULTURE. Agr. Outlook Conf., Washington, D.C., Nov. 17, 1964.

The location, extent, and prognosis of the low-income problem in agriculture were discussed. The economic causes of low incomes in the agricultural sector were listed as (1) An evolving technology of agricultural production which has steadily increased the output per unit of resource input, and altered the technical conditions of production in such manner that a given labor force can efficiently be combined with increasing quantities of other resources; and (2) significant underemployment of the human agent.

The principal implications were: (1) The low-income problem will persist for the older low-income farmer and may become relatively more severe; (2) attention needs to be focused on special programs that will prepare farm and other rural youth for productive careers in nonfarm opportunities; and (3) the persistence of relatively low incomes in the agricultural sector indicates the need for programs which will be directed toward the solution of such problems.

RDED, ERS, USDA, Washington, D.C., 20250

316. Walker, O. L. MACHINERY COMBINATIONS FOR OKLAHOMA PANHANDLE GRAIN FARMS. Okla. State U. Expt. Sta. B. B-630, 35 pp. 1964.

Machinery sets with different sizes of tractors had almost equal costs over a wide range of cropland acres. Thus, decisions as to size of tractor did not appear particularly critical. Even when a very low or very high charge was made for labor, cost differences for alternative one-tractor sets were relatively small. In general, a 5-plow tractor and equipment will allow relatively low costs per acre over common sizes of commerical farms, and provide for timely competition of jobs considered critical by farmers.

Numbers of tractors and use of custom machinery rather than owned machinery may have substantial effects on total machinery costs. If machines are available when needed, custom hiring will reduce costs on farms up to 300 acres.

A machinery plan involving purchase and maintenance of two tractors and related equipment would add about $600 to annual machinery costs on farms with 600 to 1,000 cropland acres. Jobs considered critical by farmers can be handled by one rather than two tractor sets on farms of that size.

Fixed days for completing the combining operation or willingness to pay additional costs for a larger machine as "timeliness insurance" provide an incentive to buy large combines. Large machines provide lower cost services when days to combine are fixed. Smaller machines allow lower per-acre costs when a restriction is not placed on harvest days. However, subtitution of a 14-foot machine for a 12-foot, or a 16-foot for a 12-foot on 300- to 1,000-acre jobs only requires annual "insurace" costs of $40 to $70, and $150 to $190, respectively. Breakeven acreages for custom rates of $3.00 per acre are approximately 360, 385, and 445 acres for the 12-, 14-, and 16-foot machines.

Tables and charts.

Okla. State U. Expt. Sta., Stillwater, Okla., 74075

317. Sitler, H. G. COSTS OF SELECTED SIZES AND TYPES OF FARM MACHINERY ON COLORADO WHEAT FARMS. Colo. State U., Coop. Ext. Serv. Unnumbered Rpt. 19 pp. 1964.

The tables showed 1960 average costs and time requirements for machines most frequently reported on a machinery survey of wheat farms in two areas of eastern Colorado.

These tables emphasized costs for individual machines. The tables can be useful in planning for a size of machine or a combination of machines to meet given requirements, and in developing farm budgets.

Tractor costs were shown per hour of use, truck costs per mile of use, and all other machine costs were per acre of use. Time requirements were shown for each of the tillage and harvesting machines per acre for common sizes of tractors. This time requirement can be used to determine tractor hours and man-labor hours to complete the costs of a specific tillage or harvesting practice.

Colo. State U., Coop. Ext. Serv., Fort Collins, Colo., 80521

318. Stevens, D. M. COST OF OWNING AND OPERATING FARM POWER AND MACHINERY: ON IRRIGATED FARMS IN WYOMING. Wyo. Agr. Expt. Sta. B. 421, 91 pp. 1964.

The study is divided into four parts. Part I analyses components of annual costs of owning and operating 312 farm tractors and 228 motor vehicles. Part II contains similar information for 435 harvesting machines and 250 machines used for miscellaneous purposes. Part III contains an economic analysis for 126 planting machines and 453 tillage machines. Part IV presents an explanation of the research procedure used in this study, an example of how the findings can be used in making economic machinery decisions, and a table showing the acreage covered per hour for the different machines studied.

Through statistical analysis, annual-use cost curves were derived. Cost components were presented in tabular form. Cost per unit (hour, acre, or mile) related to annual use was shown.

Tables, charts, and photographs.

U. Wyo., Agr. Expt. Sta., Laramie, Wyo., 82071

319. Kemp, A. SODIUM REQUIREMENT OF MILKING COWS: BALANCE TRIALS WITH COWS ON RATIONS OF FRESHLY MOWN HERBAGE AND ON WINTER RATIOS. Netherland J. Agr. Sci. 12(4): 263-280. 1964.

Balance trials were carried out with milking cows fed on freshly mown herbage or winter rations. Data were given on the sodium intake, sodium excretion in faeces and urine, and secretion in the milk of cows in 12 experiments. Data were also given on the influence of supplementary KCl on the excretion of sodium in urine and faeces. The sodium intake with freshly mown herbage and drinking water varied from 5.8 to 91.0 g. a day, 14.5 percent of which was excreted in the faeces. The "availability" of the sodium ingested, accordingly, averaged 85.5 percent, varying from 77 to 95 percent.

Supplementary KCl increased sodium excretion in the urine, while that in the faeces decreased. Accordingly, total-sodium excretion did not change. Increased sodium excretion in the urine mainly took place during the first few days after KCl-application.

There was a close correlation between the sodium ingested and the excretion of urinary sodium. The sodium secretion in the milk averaged 0.38 g. per l, varying from 0.31 to 0.49 per l.

The "maintenance requirement" was approximately 5.5 g. of "available sodium" per day. The daily requirement of herbage sodium for milk yields of 25 kg. per day and for an "availability" of herbage sodium of 85 percent was approximately 18.2 g.

Inst. Biol. & Chem. Res. Field Crops & Herbage, Wageningen, Netherlands.

320. Cunha, T. J., Shirley, R. L., Chapman, H. L., Jr., and Ammerman, C. B., Davis, G. K., Kirk, W. G., and Hentges, J. F., Jr. MINERALS FOR BEEF CATTLE IN FLORIDA. Fla. Agr. Expt. Sta. B. 683, 60 pp. 1964.

Proper mineral supplementation of beef cattle is very important for maximum beef production. Mineral needs varied considerably, depending on many factors which were discussed. The mineral elements apt to be lacking under Florida conditions are calcium, phosphorus, sodium, chlorine, copper, cobalt, and iron. Mineral mixtures to supply these elements for sand and muck soils were recommended.

The problem of excess molybdenum in muck soils and how to counteract its effect on cattle was discussed. Excess salts in water, which occur in parts of Florida, decrease mineral consumption unless the salt content was adjusted in the mineral mixture.

This problem was discussed and recommendations made on how to handle it. Salt can be used to control protein supplement intake by cattle. Suggestions were made on salt levels to use.

Data were presented on the mineral composition of Florida feeds and mineral supplements. Information was also given on blood and liver values of minerals to use as a guide in determining whether a deficiency may exist.

Mineral feeders were shown which may be used under Florida conditions.

U. Fla., Agr. Expt. Sta., Gainesville, Fla., 32603

Institutional, Educational, and Social Factors Affecting Conservation Application

See Also 142, 152, 155, 157, 163, 253, 255, 259, 260, 262, 274, 311, 348.

321. Baum, E. L., and Southern, J. H. NATIONAL PROGRAMS, PROGRESS, AND RESEARCH NEEDS IN AREA ECONOMIC DEVELOPMENT. Amer. Farm Econ. Assoc. Mtg., Aug. 16-19, 1964.

The background philosophy, objectives, organization, and procedures of the numerous national programs enacted by the Congress that are directly concerned with the development of the human, physical, natural, and economic resources of our rural areas were discussed. All these programs are a part of the package of tools for use by those concerned with rural area development to help ameliorate the low incomes, unemployment, and underemployment problems. Indications were given of the progress to date, with some evaluation of the programs and needed research in area economic development.

FDED, ERS, USDA, Washington, D.C., 20250

322. Wise, J. O. COMMERCIAL BANK LOANS TO GEORGIA FARMERS. Ga. Agr. Expt. Sta. Mimeo. Ser. N.S. 208, 26 pp. 1964.

Changes in the economic environment in which farmers operate are resulting in significant increases in the capital required for commercial farming. Low farm incomes and lack of savings have caused farmers to rely more and more on loans as a method of acquiring additional capital. In Georgia, the most important source of farm loans is commercial banking.

Data were given on farm loans from a sample of Georgia banks to determine the loan services and costs of loans from banks by type of farm and appraise the adequacy of banks in serving the financial needs of agriculture.

In most cases, banks charged "reasonable rates" of interest on all types of agricultural loans. Bankers in Georgia were willing to renew loans when farmers experienced bad weather or other adverse conditions. Georgia banks also have sufficient resources to permit them to make large loans.

The average loans made by the banks were small compared to the capital requirements for commercial farms in Georgia. The average loans were $1,598 for annual production loans, $2,579 for intermediate-term loans, and $4,692 for long-term loans. The corresponding capital requirements for the average commercial farm in the Coastal Plain Area in 1957 were $5,900, $6,200, and $21,700. Comparable figures for farms grossing over $10,000 were $14,400, $14,200, and $42,300. When large loans are made, they are usually made to farmers with large equities. Furthermore, loans are usually scheduled over short periods of time.

If banks are to meet the ever-increasing demand for larger, longer-term loans based on the expected returns from the use of credit, then they must (in many cases) make substantial revisions in their lending policies. If banks do not meet this challenge, farmers will turn to other sources of credit or to other methods of acquiring control over resources.

Ga. Agr. Expt. Sta., Ga. Col. Agr., Athens, Ga., 30601

323. Vermeer, J., and Aines, R. O. THE PILOT CROPLAND CONVERSION PROGRAM. U.S. Dept. Agr., Econ. Res. Serv., Farm Prod. Econ. Div. Agr. Econ. Rpt. N. 64, 47 pp. 1964.

A study was reported of the 1963 Pilot Cropland Conversion Program (CCP) in five areas after its first year of operation. The five areas included one each in North Dakota, Iowa, and Mississippi and two in Georgia. Most of the land under agreements will remain in the program for 5 years. About a third of the land in North Dakota and a tenth of the land in Georgia will remain in the program for 10 years. Payment for conversion ranged from $8 an acre for the poorest land in the program in North Dakota to $70 an acre for the best land in the program in Iowa.

The quality of land in the program appeared to be slightly below the average of the respective counties. Except in Mississippi, 1962 crop yields on participants' farms were below those on neighboring farms, and the change in crop yields from 1962 to 1963 indicated that the poorer land on participants' farms was put under agreements.

From two-thirds to four-fifths of the land under agreements in North Dakota, Mississippi, and the Coastal Plain of Georgia was used for row crops or small grains the year before it was put under a CCP agreement. Nearly all of the land will be used for pasture while under CCP agreement. Except in Iowa, from 80 to 100 percent of the land will remain in a conserving use after the agreements expire.

In each of the five areas studied, farms in the program were larger and the size increased more from 1962 to 1963 than other farms in their respective counties.

The number of livestock on all farms—chiefly beef cattle—rose rapidly during 1963, but they increased faster on participants' farms. Cash crops provided the chief source of farm income for participants and it will continue to be the main source on most farms even after fully adjusting to the CCP.

Farmers' total cash expenditures for approved cost-shared practices ranged from one-fourth to three times as large as payment received. From one-third to one-half of the farmers changed their livestock enterprises to better adapt to the CCP.

Farmers in the CCP were younger; had more education; and except in North Dakota, a slightly larger proportion of them had off-farm jobs in 1962.

Gross farm income and total debts were higher for participants than for nonparticipants, and more of the nonparticipants were debt free.

Most farmers participated in the CCP because they expected a larger or more certain income. A second reason was that the program facilitated a change to a different type of farming.

Most farmers not in the program stayed out because they expected crop production to be more profitable or because participation would interfere with desired land use.

From nearly one-half to three-fourths of the participants would extend their agreements for another 5 years on the same terms as offered for 1963. More than 90 percent in North Dakota and Mississippi would extend their contracts if payment were raised 25 percent, but very few would extend them if payments were lowered 25 percent.

Tables.

OMS, USDA, Inform. Div., Washington, D.C., 20250

324. Back, W. B. ECONOMICS IN FORMULATING PLANS FOR EASTERN RIVER BASINS. Amer. Farm Econ. Assoc. Mtg., Aug. 16-19, 1964.

Possibilities of increasing the role of economics in river basin planning, with particular reference to Eastern river basins, was appraised. Institutional problems associated with the limited applications being made of economics in water-resource development were discussed briefly, as a setting for a review of some issues in applying benefit-cost analysis to estimate economic consequences of projects differing with the appraisals made by use of benefit-cost analysis.

The interdependence of institutions and economics in river-basin development was stressed in identification of some problems warranting research attention. Generally, it was concluded that the literature on project evaluation and design to date over stresses the use of microstatic economic theory and the accompanying efficiency objectives as a norm in river-basin planning. It was proposed that the research efforts should be more empirically oriented, with emphasis on estimating the distributional and growth effects of water-resource investments and on legal and institutional conditions associated with these effects.

FDED, ERS, USDA, Washington, D.C., 20250

325. Harl, N. E. MODIFYING INSTITUTIONAL-LEGAL RELATIONS AMONG PRIVATE PARTIES TO FACILITATE ADJUSTMENT IN AGRICULTURE. Amer. Farm Econ. Assoc. Mtg., Aug. 16-19, 1964.

Law can be an instrument for achieving social and economic goals. Even though the interrelationship between law and economics (or other social sciences) has long been recognized, efforts to integrate social sciences in research have not been fully satisfactory.

Two approaches for integration of legal and economic research were discussed. In the first approach, legal research described existing law that is relevant to particular economic problems. In the second approach, change in the law was treated as a dependent variable, dependent upon not only prior law but also economic, sociological, and other factors that bear upon social issues.

Iowa State U., Ames, Iowa, 50010

326. Woodard, F. O. THE EFFECT OF SELECTED TAXES ON A SAMPLE OF FARMERS IN NEBRASKA AS INDICATED BY A SURVEY OF FHA BORROWERS. Nebr. Agr. Expt. Sta. B. SB 481, 34 pp. 1964.

The tremendous growth of taxes in recent years, together with the almost inevitable continued rise in the years ahead, makes the effect of various taxes on different segments of the economy of vital concern.

Replacement of a portion of the property tax in Nebraska by a sales or income tax, or a combination of the two, would bring about numerous changes in the State's economy. For the FHA borrower, these changes would be neither completely desirable nor completely undesirable.

A primary advantage of such a change would be the resulting reduction in fixed costs and the accompanying increase in correlation between tax liabilities and income.

The proposed changes would permit the FHA borrower to cope more successfully with periods of adverse economic conditions.

Another advantage for the FHA borrower would be the improved equalization of tax liabilities between the eastern and western areas.

Another possible advantage of the proposed change would be the encouragement of increased investment resulting from the reduction of the tax on ownership.

Perhaps the outstanding advantage to the FHA borrower which might result from this change would be an increasingly favorable economic climate. The FHA borrower perhaps would find an increased demand for his services in non-agricultural, part-time jobs.

The greatest disadvantage of the proposed change would be the generally worsened position of the tenant. His tax payments in general would be greater than is true under the present system.

The degree to which these effects could be expected to occur is dependent, of course, upon both the relative and the absolute size of the tax liabilities in the State. Many other expenses are greater than the tax expense, and this is but a minor, although important, problem for all FHA borrowers in Nebraska.

Tables.

U. Nebr. Col. Agr., Agr. Expt. Sta., Lincoln, Nebr., 68503

327. Ellis, H. H. WATER RIGHTS AND REGULATION IN THE EASTERN STATES. Nat. Well Water Assoc., Atlantic City, N.J., Sept. 21-24, 1964.

The common-law doctrines concerning rights to use natural watercourses, diffused surface water, springs, underground streams, and percolating ground water as defined by the courts in the Eastern States were discussed. Legislative developments in such states were also discussed, including the various permit systems that have been established and the authorized functions of state and local governments and resource districts pertaining to water rights, regulation, and related matters. Emerging issues and problems were also considered.

RDED, ERS, USDA, Law School Bldg., U. Wis., Madison, Wis., 53706

328. Anderson, L. O., and Liska, J. A. WOOD STRUCTURE PERFORMANCE IN AN EARTHQUAKE. U.S. Forest Serv. Res. Paper FPL-16, 13 pp. 1964.

Well-constructed, light wood frame buildings, for the most part, resisted the shock forces of the earthquake that occurred in Alaska on Good Friday of 1964. This was not generally true of other types of construction. Because the majority of the homes in the Anchorage area were of wood frame construction, damages were usually superficial except in those areas where severe earth subsidence had occurred. There was some variation in the performance of the houses, based on material, fastening methods, and construction details.

Because the primary purpose of the survey was the investigation of wood frame structure, the majority of the descriptions covered such units. However, to provide information for the development of better construction details for small buildings constructed of a combination of materials, illustrations and details of many types of failures were included.

Photographs.

Forest Products Lab., FS, USDA, Madison, Wis., 53706

329. Woudt, B. C., van't. PAST AND PRESENT SOIL CONSERVATION IN THE ORIENT. Annu. B. Internatl. Comn. Irrig. and Drain. New Delhi, India. pp 39-42. 1963.

A report was given on the past and present soil conservation methods used in the Orient. Rock bench terraces and benches hewn out of subsoil have been used for centuries in the mountainous areas. At the present time, illegal burning and cropping of public watersheds with little or no soil conservation measures have caused considerable erosion. As a consequence of baring the soil above the terraces, the water resources have doubled and floods have tended to cause washout of the benches.

FAO, Maliwan Mansion, Phra Atit Road, Bangkok, Thailand.

330. Buie, T. S. AFTER THIRTY YEARS: PART TWO. J. Soil and Water Conserv. 19(4): 147-152. 1964.

This is the second part of an article on the important things that have happened in soil and water conservation during the past three decades.

Retired, SCS, USDA, 482 Pinckney Court, Spartanburg, S.C., 29301

331. Anderson, R. L. WILD RIVERS: AN ADDED DIMENSION IN WATER RESOURCE USE. Western Agr. Econ. Res. Comn. San Francisco, Calif., Dec. 9, 1964.

Wild-river studies are being made in an attempt to identify and preserve portions of the few remaining natural waterways in the United States. Currently, 22 rivers are under consideration for possible wild-river designation. These rivers exhibit a variety of outstanding examples of natural free-flowing streams. The criteria used in studying the rivers were described, and some of the economic problems of evaluating the potential wild-river areas were discussed.

RDED, ERS, USDA, Colo. State U., Fort Collins, Colo., 80521

332. Gray, J. R., and Anderson, L. W. USE OF NATURAL RESOURCES IN THE RUIDOSO RANGER DISTRICT. N. Mex. Agr. Expt. Sta. B. 489, 29 pp. 1964.

The findings were reported from an analysis of the values of multiple uses of the natural resources in the Ruidoso Ranger District of the Lincoln National Forest in south-central New Mexico. Static linear programming was used to determine the optimum resource uses.

Several assumptions were made so that the static linear programming technique could be used. They were: That a demand existed in 1962 and will exist in 2000 for all resources in the district; that institutional barriers will be lifted to permit changes in resource use; that only competitive and supplementary relationships exist among resource uses; and that the average quantities of resources needed to produce a given quantity of product in 1962 will be the same in the year 2000.

With the above limitations and assumptions, the authors concluded that:

1. In 1962 the gross annual value of all uses except mining in the District was 16.9 million dollars. Estimated net cash income was 4.2 million dollars. If optimum use had been made of resources, the gross annual value of all uses in 1962 would have been 24.2 million dollars. Net cash income was estimated at 11.5 million dollars. These benefits would have been shared by business firms located within 500 miles of the district.

2. The gross return in the district in 1962 was $95 per acre. The annual net cash income accuring to the region was $24 per acre. With optimum allocations of resources, these returns could have been increased to $136 and $65, respectively.
3. By the year 2000, optimum allocations of resources could yield a gross value to the region of 30.8 to 74.9 million dollars, depending upon price levels and the quantities of natural and economic resources available. Net cash incomes would range from 11.8 to 36.9 million dollars.
4. The recreational activities—camping and picnicking, cabin ownership, hunting and fishing, and skiing—were the most valuable uses of the district.
5. Many kinds of land resources were left unused when the best combination of uses was determined. These unused resources included timber land, grazing land, hiking, and some camping and homesite land.
6. When all of the strategic natural resources were used, the gross annual value of the resources in 1962 was increased by less than 1 percent.
7. If price levels of products in the year 2000 are no higher than they were in 1962, only a modest increase of natural and economic resources seems to be warranted. If prices of products are as much as 50 percent higher in 2000, a high level of development would be warranted.

Agr. Expt. Sta., N. Mex. State U., State College, N. Mex., 88070

333. Davis, J. M. NEW ENGLAND FARM VACATION BUSINESSES: CHARACTERISTICS AND OWNERS' EXPERIENCES. U.S. Dept. Agr., Econ. Res. Serv., Resource Develop. Econ. Div., Agr. Econ. Rpt. N. 60, 20 pp. 1964.

Farm vacation businesses provide needed additional income for numerous New England families. City people began visiting farms in the region decades ago. New England's recreation attractions and widespread advertising give farm vacation facilities in this region an extra advantage.

Advantages of a farm-vacation business include: Earning additional cash income; meeting interesting people; learning about other places; helping city people learn about farm life; and being appreciated for skills that the family and neighbors often take for granted.

Some disadvantages inherent in farm vacation businesses include: A short summer season; adverse weather and other conditions over which operators have no control; occasional difficulties with uncooperative guests; lack of privacy; and the fact that the income may be low.

The vacation season varies from farm to farm in New England.

Typical working and guest farms included in this survey could house an average of 10 guests at one time. Guests at most farms stayed in the farmhouse and ate with the farm family. Charges for room and board for adults ranged from about $28 to $60 per week; rates for children ranged from $20 to $35.

Recreation facilities attract guests; yet advertisements frequently failed to mention those available. Fishing was the onsite recreation most often mentioned.

Most visitors were from the New York City and Boston metropolitan areas. Family groups predominated, although there were single guests and many couples.

Guests appreciated the restful atmosphere, the different way of life, the new experiences for themselves and their children; the open space, the quiet, the farm animals and farm activities, the freedom, the low cost, and the farm as a center for sightseeing trips. These combined features make farm vacations unique.

OMS, USDA, Inform. Div., Washington, D.C., 20250

334. Heath, E. I. COMPARISON OF RECREATIONAL DEVELOPMENT PLANS FOR A NORTHERN MAINE WILDERNESS TRACT. Maine Agr. Expt. Sta. B. 628, 51 pp. 1964.

Recreational use of the nation's remaining wilderness resouces has become a prominent land use problem. Attempts to satisfy the increasing demand for wilderness recreation, and in turn follow the concept of wilderness preservation, have appeared incompatible. Alternative recreational development plans of a wilderness area composed of Baxter State Park and the surrounding townships were designed and compared. To accomplish this: (1) The future annual camper night use was first determined: (2) an inventory of the recreational resources was conducted; and (3) development plans were designed.

Four major development plans were proposed: An internal plan; a peripheral plan; an external plan; and a combination plan. To provide a further means of comparison, two alternative plans were designed for each of the major plans. These alternatives were compared in acres, units, camper capacity, density, percentage of total area within the park used for development, and development costs. Each plan was designed to accommodate the anticipated annual camper night use of 94,920 by 1976.

The eight alternatives varied in design. Some attempted to satisfy the majority of recreationists by providing access roads to proposed campgrounds. Others favored the minority by restricting travel within the area to hiking. Regardless of the alternative proposed, very little of the wilderness area was used in the proposed development of campgrounds. The largest acreage required for development was 244, or 0.11 percent of total area within Baxter State Park. Other alternatives required as little as 0.03 percent of the total area.

To determine the development costs for each plan, the construction costs for each individual campground proposed were computed. Development costs varied considerably. One alternative, proposing construction of a perimeter road, could be developed for an estimated $2,540,402. In contrast, an alternative closely resembling the park design at the present could be developed for an estimated $133,408.

Maine Agr. Expt. Sta., U. Maine, Orono, Maine, 04473

BIOLOGY

Fish

See Also 51, 162, 373.

335. Tebo, L. B., Jr., and McCoy, E. G. EFFECT OF SEA-WATER CONCENTRATION ON THE REPRODUCTION AND SURVIVAL OF LARGEMOUTH BASS AND BLUEGILLS. Prog. Fish-Cult. 26(3): 99-106. 1964.

On the basis of the bio-assay studies, it appears that approximately 10 to 12 percent sea water (osmotic pressure of 2.34 to 2.80 atmospheres) is the maximum concentration at which bass and bluegills can successfully reproduce. Fingerlings of these species can survive, at least for short periods, in concentrations of 29 to 38 percent sea water (osmotic pressure of 6.78 to 8.90 atmospheres).

In stream surveys on the downstream sections of the Neuse River in North Carolina, information was obtained on the distribution of various species of fish in relation to the concentration of sea water (Keup and Bayless (1963)). Eighteen stations that had concentrations ranging from 0 to 35 percent sea water were sampled. Sampling was done with emulsified rotenone, and an attempt was made to obtain representatives of all species present in the area sampled. In the Centrarchidae, 9 of 12 species were found only in areas having less than 10 percent sea water. Bluegills were found at concentrations ranging from 0 to 10 percent sea water. Largemouth bass were present in areas where sea-water concentrations ranged from 0 to 29 percent. The frequency of occurrence of largemouth bass dropped sharply in areas having more than 10 percent sea water. Brackish-water species such as white perch, tidewater silversides, and rainwater killifish most frequently occurred in samples where the sea-water concentration ranged from 10 to 30 percent.

U.S. Public Health Serv., Cincinnati, Ohio, 45201

336. Cope, O. B. REVISED BIBLIOGRAPHY ON THE CUTTHROAT TROUT. U.S. Dept. Int., Bur. Sport Fisheries and Wildlife Res. Rpt. 65, 43 pp. 1964.

A compilation of 221 abstracts of publications on the biology, culture, distribution, and management of the cutthroat trout, (Salmo clarki Richardson) was given. The 1958 publication, "Annotated Bibliography on the Cutthroat Trout," contained 135 abstracts, which have been incorporated with recent ones to form the present report.

Bur. Sport Fisheries and Wildlife, U.S. Dept. Int., Washington, D.C., 20240

337. Allanson, B. R., and Noble, R. G. THE TOLERANCE OF TILAPIA MOSSAMBICA (PETERS) TO HIGH TEMPERATURE. Trans. Amer. Fisheries Soc. 93(4): 323-332. 1964.

The median lethal temperatures for Tilapia mossambica (Peters) at different acclimation temperatures were estimated, and the ultimate upper lethal temperature was found to lie between 38.20° C. and 38.25° C. The effects of acclimation temperature and period of acclimation upon resistance were also investigated. An average acclimation rate of 1° per 150 minutes was estimated for fish transferred directly from 25° C. to 30° C., whereas it was observed that fish transferred from 25° C. to 15° C. were not fully acclimated even after 20 days. These data confirm that T. mossambica is a thermophilic species.

Rhodes U., Grahamstown, South Africa.

338. Klussmann, W. CHANNEL CATFISH FARMING. Tex. Agr. Expt. Sta. B. B-1024, 12 pp. 1964.

Commercial catfish production, a relatively new industry, is fast gaining interest in Texas. This farm enterprise involves feeding catfish as one would feed calves in a feedlot. The result is increased pounds of fish per surface acre of water. Supplemental fish feeding can be a large commercial operation, or for the family food suppy. The publication was written for the individual who plans to pursue catfish production on a rather large scale.

Before beginning an enterprise like this, one should consider the economic feasibility of the locality. Among the more important considerations are: The population of the consuming area; market prices of dressed fish (prices vary over the State); source of water; topography of land; and soil type.

Tex. A&M U., Tex. Agr. Ext. Serv., College Station, Tex., 77841

339. Klussmann, W. G., and Lowman, F. G. COMMON AQUATIC PLANTS: IDENTIFICATION; CONTROL. Tex. Agr. Expt. Sta. B. B-1018, 16 pp. 1964.

Control of undesirable aquatic plants is a major problem of pond and lake owners in Texas. Adding to the problem is the necessity of identifying the plant before a control practice can be put into use. Correct identifications are essential, since most herbicides control or kill only a limited number of different kinds of aquatic plants.

Hundreds of different species of aquatic plants grow in Texas waters. Many are desirable and do not need control. Only those aquatic plants which occur commonly in some area of Texas and which may be detrimental to pond management and fishing were discussed.

Troublesome plants must be eradicated or controlled to carry on a good pond management program, including fertilization. Fertilizing a standing crop of weeds only adds to their rapid growth and increases problems of pond management.

Tex. Agr. Ext. Serv., Tex. A&M U., College Station, Tex., 77841

340. Foye, R. E. CHEMICAL RECLAMATION OF FORTY-EIGHT PONDS IN MAINE. Prog. Fish-Cult. 26(4): 181-185. 1964.

Competitive fishes were completely removed in 24 of 48 ponds reclaimed in Maine between 1949 and 1959.

Incomplete kills were effected with all products and concentrations when each—with the exception of Fish Tox, which contains both rotenone and toxaphene—was used more than once. With the exception of Fish Tox, no product or concentration was more efficient than another in effecting complete kills.

Thirteen species suffered a complete kill each time they occurred in a treated pond, whereas 17 other species suffered one or more incomplete kills. Fishes with the greatest number of incomplete kills were largely stream-dwelling species. Bullheads, generally considered one of the more difficult species to eradicate, were removed successfully from many waters with rotenone concentrations of 1 p.p.m. or less.

Incomplete kills of certain species occurred in some deep ponds, even though toxicants were pumped into the deep water. The reestablishment of undesirable species in these waters was attributed to incomplete kills in the tributaries of these ponds rather than to inadequate treatment of the deep water. The data strongly suggest that incomplete kills in tributaries have been largely responsible for the reestablishing of several competitive species in three hard-water ponds, but the deterrent effect of high alkalinity upon the toxicity of rotenone may have contributed to the survival of fish in these waters. Most of the waters reclaimed are soft-water ponds, where the effects of alkalinity on rotenone are not adverse.

Though many factors may influence the ability to remove competitive fishes, the major factor apparently is the inability to treat the tributaries and adjacent marshes effectively.

Maine Dept. Inland Fishers & Game, Augusta, Maine, 04330

341. Jensen, L. D., and Gaufin, A. R. LONG-TERM EFFECTS OF ORGANIC INSECTICIDES ON TWO SPECIES OF STONEFLY NAIADS. Trans. Amer. Fisheries Soc. 93(4): 357-363. 1964.

Two species of stonefly naiads, Acroneuria pacifica Banks and Pteronarcys californica Newport, were exposed to various organic insecticides for a period of 30 days in concentrations at or less than the 4-day TL_m concentrations for each species. In general, the concentrations at or near the 4-day TL_m concentrations were lethal to 50 percent of the specimens within 4 to 10 days of continuous exposure. Less concentrated solutions produced toxic symptoms after 10 to 14 days. With some insecticides, these symptoms appeared only after 21 days of continuous exposure. Normal molting of the specimens was inhibited in the aquaria at or near the 4 day TL_m concentrations. In lesser concentrations, molting was not reduced until after 21 to 25 days of exposure, at which time marked reductions in molting rates were observed.

U. Utah, Salt Lake City, Utah, 84112

Upland Wildlife

342. Erickson, A. W., Nellor, J. E., and Petrides, G. A. THE BLACK BEAR IN MICHIGAN. Mich. Agr. Expt. Sta. Res. B. 4, 102 pp. 1964.

Few North American mammals evoke more human interest than the black bear. Relatively little has been learned of the biology, ecology, or population status of the species. Management of the black bear has, therefore, been generally less precise than may otherwise have been desired.

Three investigations dealing with aspects of the life history, ecology, and management of the black bear in Michigan were reported in the following three parts: (1) Detail breeding biology of the species as determined from histological studies of reproductive tracts, published literature, and field observations; (2) population structure, movements, and mortality of bears as shown from capture and recovery of marked bears; and (3) harvest statistics of black bears in Michigan as provided by questionnaire surveys of hunters.

Mich. State U., Agr. Expt. Sta., East Lansing, Mich., 48823

343. Thomas, J. W., Teer, J. G., and Walker, E. A. MOBILITY AND HOME RANGE OF WHITE-TAILED DEER ON THE EDWARDS PLATEAU IN TEXAS. J. Wildlife Mangt. 28(3): 463-472. 1964.

Two hundred forty-one deer (Odocoileus virginianus) were trapped and ear-tagged over a 3-year period. Recoveries of these animals were from three sources: Deer retrapped; deer shot by hunters; and deer found dead. Four traplines, involving 55 trap locations, were located astride the transition zone between limestone and granitic soils.

Recoveries were obtained on 58.9 percent of the deer over a 6-year period. Of the three types of recoveries, those from deer harvested by hunters were thought to yield the most reliable statistics. Figures derived from other recoveries were subject to such bias that they were presented only as supporting evidence. Only 3 of 186 recoveries were from distances greater than 1-1/2 miles from the point of original marking; the indicated average movement was 717 yards from the point of marking. There appeared to be no relation between the amount of time elapsed from marking to recovery and distances moved. Male deer had a somewhat greater average movement than females.

Tex. Game & Fish Comn., Llano, Tex., 78643

344. McMillan, I. I. ANNUAL POPULATION CHANGES IN CALIFORNIA QUAIL. J. Wildlife Mangt. 28(4): 702-711. 1964.

A population of California quail (Lophortyx californicus) in San Luis Obispo County, Calif., was kept under study and management from 1946-62. Observations and age ratios obtained during fall hunting have indicated wide fluctuation of reproductive success, age ratios varying from 6-81 percent young. In general, years of high rainfall correlated with high reproduction; dry winters were followed by reduced breeding.

The key factor in reproductive rate was the drive to keep nesting and renesting throughout the summer, resulting presumably from a physiological preconditioning whose nature and origin are unknown. Reproductive drive was shown to be independent of environmental conditions during the actual nesting season, appearing to be related more to early breeding-season weather conditions that control annual plant growth and production of quail food.

Shandon, Calif., 93461

345. Edwards, W. R. EVIDENCE FOR A NORMAL AGE COMPOSITION FOR COTTONTAILS. J. Wildlife Mangt. 28(4): 738-742. 1964.

The juvenile:adult age composition of statewide cottontail (Sylvilagus floridanus) populations in Ohio, Illinois, Wisconsin, Missouri, and Michigan showed similar characteristics of age structure which support Lotka's (1925) concept of the normal age distribution. Because of apparent similarities in the age composition of statewide populations, and because age ratios of cottontail populations on individual units of range differ significantly between years and areas, it was believed that: (1) There is, in the Midwest, a normal age structure for cottontails; and that (2) the age structure of the individual population varies about the normal, within limits, in response to factors in the physical environment. The normal or expected proportion of juvenile rabbits in fall populations in the Midwest, with 95 percent confidence limits, was estimated as 0.834 ± 0.005.

Ill. Nat. Hist. Survey, Urbana, Ill., 61803

346. Toth, S. J., McLain, P., and MacNamara, L. G. FERTILIZATION OF BURNET FOR GAME FOOD ON LAKEWOOD SAND SOILS. J. Wildlife Mangt. 28(4): 840-845. 1964.

Field tests were conducted for 3 years on a Lakewood sand to determine the fertilizer needs of burnet (Sanguisorba minor), which is grown as a bird and game animal feed in New Jersey on public hunting and fishing areas. Maximum burnet seed yields were obtained when 600 pounds of a 5-10-10 fertilizer were broadcast over established stands in the spring of each year. The most economical fertilizer practice for producing seed yields and high quality forage involved the topdressing of established stands of burnet in the spring with 300 pounds of 5-10-10 fertilizer, followed by topdressing with 50 pounds of inorganic N per acre after seed maturation.

Rutgers—The State U., New Brunswick, N.J., 08903

347. Newlon, C. F., Baskett, T. S., Breitenbach, R. P., and Stanford, J. A. SUSTAINING VALUES OF EMERGENCY FOODS FOR BOBWHITES. J. Wildlife Mangt. 28(3): 532-542. 1964.

Sustaining values of foods that might be useful to bobwhites (Colinus virginianus) under emergency conditions were tested by feeding penned bobwhites single foods during fall and winter, and observing their survival and condition. In the pilot study, 11 foods were tested for 38 days; 132 bobwhites of mixed sex- and age-groups were employed. In the principal study, 6 of these foods were tested for 14 days on 84 young birds of both sexes.

On the basis of food consumption, weight performance, depot fat, lipid levels, and other physiological measures, pearl millet (Pennisetum glaucum), sassafras (Sassafras albidum), foxtail millet (Setaria italica), and milo (Sorgum vulgare) had the highest sustaining values among the foods tested. Their values exceeded those of such well-known winter staples for bobwhites as corn (Zea mays), Korean lespedeza (Lespedeza stipulacea), Sericea (Lespedeza cuneata), rose (Rosa multiflora) hips, and smooth sumac (Rhus glabra) in that order.

Missouri Coop. Wildlife Research Unit, Columbia, Mo., 65201

348. Joselyn, G. B., and Warnock, J. E. VALUE OF FEDERAL FEED GRAIN PROGRAM TO PRODUCTION OF PHEASANTS IN ILLINOIS. J. Wildlife Mangt. 28(3): 547-551. 1964.

Data were presented on the beneficial effects of the Federal Feed Grain Program on the production of pheasants (Phasianus colchicus) on a 23,200-acre study area in Ford and McLean counties, east-central Illinois, in 1962 and 1963. One hundred 10-acre plots (4.3 percent of the study area) were cover-mapped to obtain a sample of land-use practices, and were searched for pheasant nests in both years.

Farmers with land on the study plots were interviewed to learn what crops would have been planted on the plots in the absence of the Federal Feed Grain Program. In 1962, 16.5 percent of the acreage in harvested hay, 61.6 percent of the acreage in unharvested hay, and 10.5 percent of the acreage in small grain on the 100 plots would have been planted to corn or soybeans, in the absence of the program. In 1963, without the federal program, there would have been 4.7 percent less harvested hay, 54.0 percent less unharvested hay, and 52.9 percent less small grain on the 100 plots.

Of all successful nests located on the plots, 38.8 percent in 1962 and 27.5 percent in 1963 occurred on land which would have been planted in corn or soybeans, in the absence of the Federal Feed Grain Program. Changes were recommended in the regulations for mowing unharvested acres, to make the program more effective for the production of pheasants in Illinois.

Ill. Nat. Hist. Survey, Urbana, Ill., 61803

349. Korschgen, L. J. FOODS AND NUTRITION OF MISSOURI AND MIDWESTERN PHEASANTS. Trans. North Amer. Wildlife and Natural Resources Conf. 29: 159-181. 1964.

The results were reported of 10 years' research to learn foods, feeding habits, and nutrition aspects of the ring-necked pheasant (Phasianus colchicus torquatus). Special objectives related to factors that may affect distribution of pheasants included: (1) Principal seasonal and year-round foods, by sex; (2) importance of agricultural crops and native foods; (3) proximate chemical composition of wild pheasant diets; and (4) sources and amounts of minerals, particularly calcium, obtained by birds in occupied range.

The study initially pertained only to Missouri, but later phases included materials from eight additional states: Iowa; Michigan; Minnesota; Nebraska; North Dakota; Ohio; South Dakota; and Wisconsin.

Mo. Conserv. Comn., Columbia, Mo., 65201

350. Warnock, J. E., and Joselyn, G. B. NESTING OF PHEASANTS IN SOYBEAN FIELDS. J. Wildlife Mangt. 28(3): 589-591. 1964.

A search of 50 acres of soybeans, comprising portions of 11 fields on a 23,200-acre study area in east-central Illinois, indicated a density of 10 pheasant (Phasianus colchicus) nets per 100 acres of soybeans. Eggs hatched in three of the five nests (60 percent) located in soybean fields. In 1963, as much as 13 percent of all successful pheasant nests on the study area may have been established in soybean acreage.

Ill. Nat. Hist. Survey, Urbana, Ill., 61803

351. Ullrey, D. E., Youatt, W. G., Johnson, H. E., Ku, P. K., and Fay, L. D. DIGESTIBILITY OF CEDAR AND ASPEN BROWSE FOR THE WHITE-TAILED DEER. J. Wildlife Mangt. 28(4): 791-797. 1964.

Fourteen pregnant white-tailed deer (*Odocoileus virginianus*), 2-5 years old, were used to study the digestibility of browse from northern white cedar (*Thuja occidentalis*) and from large-toothed aspen (*Populus grandidentata*). Consumption of cedar exceeded consumption of aspen three to seven times, and weight loss was appreciably more in the latter group that consumed aspen. The apparent digestibility of the dry matter, crude fiber, nitrogen-free extract, and gross energy of cedar generally exceeded the corresponding values for aspen. Cellular hematology differences between treatments were not significant, but total serum protein concentrations declined with time in both groups. The rumen liquor of aspen-fed deer had a higher concentration of ammonia nitrogen, expressed as a percent of total nitrogen, and a lower concentration of butyric, propionic, and acetic acids.

Mich. State U., East Lansing, Mich., 48823

352. Halls, L. I., Lay, D. W., Boyd, C. E., and Goodrum, P. D. HIGH HOPES FOR HARDWOODS. Tex. Game and Fish, 22(11): 4-5, 21. 1964.

A 10-yr. joint program to learn the facts about hardwood requirements for game production is now under way on the Stephen F. Austin Experimental Forest in Texas.

Field laboratory for the studies is a forest dominated by commercial-size loblolly and shortleaf pine, but with oaks, hickories, sweetgum, and other hardwoods comprising about 23 percent of the stand.

A 306-acre tract was divided into two 153-acre unites by an 8-foot woven wire fence. In one unit, all the hardwoods (except dogwood) larger than 2 inches d.b.h. (diameter at breast height) were removed in a commercial sale or deadened by stem injections of 2,4-D amine. The other unit will retain its natural stand.

In 1965, each enclosure will be stocked with three fawns—two does and one buck. After the second year, some animals will be removed annually for study and the rest of the natural increase retained to build up each herd to match its available food supply. As deer are trapped and removed or observed with binoculars, data will be taken to measure their health and productiveness.

Among other things, these observations will show: (1) Which plants deer prefer; (2) how deer diet changes with the amount and kind of available food; (3) how mast production affects deer carrying capacity; (4) what the best indications are of too few or too many deer; (5) how deer food is influenced by changing timber stand conditions; (6) how many deer can be grown and harvested under various forest conditions; and (7) how deer size, condition, and reproduction are related to deer concentration and forage yields.

Before any trees were cut or killed the squirrel population was estimated. As with deer, data will be collected on the habitat. The information should tell: (1) How yields of acorns and other fruits affect squirrel reproduction and nesting habits; (2) how yields of acorns and other fruits vary with timber stocking and weather; (3) what effect the availability of nesting cavities has on squirrel numbers, on areas with and without hardwoods; and (4) the period of gestation for fox squirrels.

No address given.

353. Patton, D. R., and McGinnes, B. S. DEER BROWSE RELATIVE TO AGE AND INTENSITY OF TIMBER HARVEST. J. Wildlife Mangt. 28(3): 458-463. 1964.

The response of deer (*Odocoileus virginianus*) browse in a forest stand, to different cutting intensities and the age of cut was determined. Browse was clipped on 4 uncut and 45 cut areas 1/2 acre in size in a Mixed Oak-Pine type. The cuts were made from 1 to 4 years prior to this study, and had from 22 percent to 78 percent of the basal area removed.

A conversion factor was computed to convert basal area at 8 inches to basal area at d.b.h. Each 1/2-acre unit had four clip plots. The average of the four plots was converted to pounds per acre for the 49 units. Data from the cut units were subjected to a regression analysis, using the number of years after cutting and the percent of basal area removed as variables. An R^2 of 0.466 was accepted as significant, as was the total regression. The final estimating equation was $\log \hat{y}=1.011106 + 0.068343x_1 + 0.013834x_2$. Using this equation, a table was prepared for predicting browse from 1 to 4 years after cutting, with 30 percent to 80 percent of the basal area removed.

Va. Polytech. Inst., Blacksburg, Va., 24061

354. Elder, W. H. CHEMICAL INHIBITORS OF OVULATION IN THE PIGEON. J. Wildlife Mangt. 28(3): 556-575. 1964.

The recent increase in the numbers of several species of native blackbirds, as well as the increasing concern over the numbers of such exotic birds as starlings (*Sturnus vulgaris*), house sparrows (*Passer domesticus*), and pigeons (*Columba livia*), has prompted widespread study of control methods. The results of a 4-year search for a practical oral contraceptive for nuisance birds was reported.

Most substances found effective in inhibiting ovulation in other animals proved to have little effect on pigeons, even in nearly lethal doses. Compounds used included: Tranquilizers; gametocides; antithyroid compounds; hypophyseal inhibitors; insecticides; fungicides; and coccidiostats.

Only provera at 0.1 percent or more in the diet and arasan at 0.35 percent inhibited ovulation without severe debilitation of the birds; the effect was lost as soon as the materials were withdrawn from the diets.

Practical results were obtained with the anticholesterol compound SC-12937 (22, 25-diazacholestanol dihydrochloride). When this compound constituted 0.1 percent of the diet for 10 days in early November, no eggs were laid for 3 months, full fertility among some birds was not reached for 6 months, and some remained anovulatory for 12 months. Following spring feeding, ovulation was almost completely inhibited for 3 months, and after 6 months remained 75 percent inhibited.

U. Mo., Columbia, Mo., 65202

355. Howard, W. E. INTRODUCED BROWSING MAMMALS AND HABITAT STABILITY IN NEW ZEALAND. Wildlife Mangt. 28(3): 421-429. 1964.

The introduction of the red deer (*Cervus elaphus*), an Australian opossum (*Trichosurus vulpecula*), and other species into New Zealand provides a classical example of how introduced browsing mammals, under certain conditions, can upset the natural stability of wildlife habitats either temporarily or indefinitely by destroying the vegetation and causing extensive erosion.

The following factors help explain why these introduced animals were so destructive to certain habitats: (1) Some New Zealand plants have little innate resistance to heavy browsing pressure. Apparently this is because most of the flora is composed of species that are found only in that country and because they have evolved in the absence of browsing mammals, since no fossil or native land mammals occur there except bats and the kiore rat (Rattus exulans). And (2) some New Zealand soils are highly susceptible to erosion. Because of the destruction of certain plants, an irreversible change in the composition of the vegetation has occurred.

A new and stable equilibrium of the animal-vegetation-soil complex has developed where browse-resistant and unpalatable plants have adequately replaced those that were destroyed by the browsing mammals. To stabilize the remaining habitats may require either: (1) Intensive artifical control of the mammals; (2) the practicing of modern game management principles; (3) reseeding with exotic plants where native species cannot withstand the new environmental conditions; or (4) a combination of these. It is not a realistic objective either to attempt to reestablish the original palatable plants in some areas or to try and eradicate these wild mammals from New Zealand.

U. Calif., Davis, Calif., 95616

356. McMahan, C. A. COMPARATIVE FOOD HABITS OF DEER AND THREE CLASSES OF LIVESTOCK. J. Wildlife Mangt. 28(4): 798-808. 1964.

To observe forage competition between deer and livestock, the forage selections of a tame deer (Odocoileus virginianus), a goat, a sheep, and a cow were observed under four range conditions, using both stocked and unstocked experimental pastures, on the Kerr Wildlife Management Area in Texas in 1959. The animals were trained in 2 months of preliminary testing. The technique employed consisted of recording the number of bites taken of each plant species by each animal during a 45-minute grazing period in each pasture each week for 1 year.

Results indicated moderate to heavy competition for browse and mast between the deer and the goat in all pastures during all seasons, and between the deer and all three classes of livestock in the winter. Browse and mast comprised over 50 percent of the deer's diet, except in the spring and summer, and over 50 percent of the goat's diet in all seasons. Following a decrease in available browse, sheep become competitive with deer for forbs. Forbs formed an average of 68 percent of the deer's diet and 65 percent of the sheep's diet in the ungrazed control pasture in the summer; the animals generally were grazing the same species.

The added factors of bearing and nursing fawns, and growing antlers, contributed to the nutritional stresses on deer in the summer, the period when extensive die-offs of deer most frequently occur in the region.

Competition for grass between deer and livestock probably is important only when grass is in a succulent stage in the spring and no other forage is available in quantity. Continuous grazing by animals tends to remove the most palatable species and concentrates competition on fewer, less palatable ones.

Tex. Park and Wildlife Dept., Hunt, Tex., 78024

357. Reynolds, H. G. SOME LIVESTOCK-WILDLIFE HABITAT RELATIONS IN ARIZONA AND NEW MEXICO. Amer. Soc. Range Mangt. N. Mex. Sec. Proc. 13 pp. 1964.

Wildlife habitat research (with emphasis on deer) was initiated by the Rocky Mountain Forest and Range Experiment Station in Arizona and New Mexico in the summer of 1961. The program was oriented to habitats of forest and woodland elevations.

Early findings on the logging of forested habitats were: (1) Conservation, selective logging improved deer habitat; (2) length of timber cutting cycles might be adjusted to maintain greater amounts of forage for deer; and (3) thinning pole-sized stands of timber should benefit deer habitat.

Early findings on openings of forested habitats were: (1) Natural openings were important areas for deer, elk, and cattle. Deer used forest borders heavily in spruce-fir, elk used openings to the greatest extent in ponderosa pine, and cattle made heavy use of openings throughout forested lands. (2) When small openings were created by clear-cutting of timber, the same relation as for natural openings held for deer and elk. Cattle, on the other hand, made little use of created openings. And (3) some management implications from opening studies were: Natural openings should be maintained in forests, particularly if trees are invading; and, habitat conditions for elk and deer might be improved by clear-cutting timber in strips, blocks, or natural tree groups.

Early findings with regard to pinyon-juniper woodland gave the following guides: (1) Livestock range improvement might be coordinated with deer and elk habitat preservation by leaving trees on slopes greater than 15 percent and on northeastern exposures; and (2) on sites reserved specifically for habitat, elk and deer use might be improved by thinning to 150 trees per acre to enhance understory shrub production.

Where pinyon-juniper overtops sagebrush, and is intermixed with a comparatively good stand (100-150 shrubs per acre) of mature cliffrose, forage production and deer use tended to be improved by overstory reduction.

Rocky Mountain Forest & Range Expt. Sta., FS, USDA, Fort Collins, Colo., 80521

Wetland Wildlife

358. Longcore, J. R., and Cornwell, G. W. THE CONSUMPTION OF NATURAL FOODS BY CAPTIVE CANVASBACKS AND LESSER SCAUPS. J. Wildlife Mangt. 28(3): 527-531. 1964.

Twenty-one immature lesser scaups (Aythya affinis) and 16 immature canvasbacks (Aythya valisineria) were fed natural foods from October 2 to December 13, 1961. Food materials consisted primarily of wild celery (Vallisneria americana), 63.7 percent; waterweed (Elodea canadensis), 15.1 percent; and invertebrate animals, mainly mollusks, 13.3 percent. Over the 72-day feeding period, the mean daily food intake per canvasback was 0.78 pound (wet weight) or 0.05 pound (dry weight). The mean daily food intake per lesser scaup was 0.49 pound (wet weight) or 0.03 pound (dry weight). Food consumption of the canvasback increased by 74 percent and that of the lesser scaup by 66 percent with a decline in mean maximum and minimum air temperatures of 16.9° and 11.6° F., respectively.

Over two-thirds of the experimental birds were in good to excellent condition at the time of necropsy. The captive ducks apparently received supplies of food adequate for maintenance of good health.

U. Mich., Ann Arbor, Mich., 48104

359. Bellrose, F. C., Johnson, K. L., and Meyers, T. U. RELATIVE VALUE OF NATURAL CAVITIES AND NESTING HOUSES FOR WOOD DUCKS. J. Wildlife Mangt. 28(4): 661-676. 1964.

Low occupancy of nest houses by wood ducks (Aix sponsa) does not necessarily indicate an abundance of nest sites in natural cavities, but rather either a low breeding population or nest houses improperly constructed or placed. A low breeding population may be caused by high nest losses to predators, shortcomings in the breeding habitat, or shooting losses. Nest houses which afford superior protection from predators increase numbers of wood ducks, even in habitats with abundant natural cavities.

On Quiver Creek in central Illinois, utilization of predator-proof nest houses increased the breeding population of wood ducks from 10-15 pairs to over 90 pairs. Cylindrical metal houses afford greater protection that board houses, but were widely acceptable only when: (1) There was a high density of breeding wood ducks; (2) the breeding population was expanding; or (3) a local population was conditioned to nesting in houses. After initial use of metal houses by wood ducks, high nesting success was usually followed by increased usage as homing adults and yearlings swelled the local breeding population.

Adult wood duck hens usually return to the nesting areas where they last bred successfully. A large proportion of yearling hens return to their former rearing areas. Yearling hens nest later than older hens, and, by observing specific nesting areas and sites used by adults, were influenced to nest nearby and in similar accommodations. The homing of females to a specific nesting area emphasizes the advantage of grouping nest houses in units. Houses should be spaced according to habitat and potential breeding population: two to three per acre in high-quality habitat were recommended.

Ill. Nat. Hist. Survey, Urbana, Ill., 61803

360. Beard, E. B. DUCK BROOD BEHAVIOR AT THE SENEY NATIONAL WILDLIFE REFUGE. J. Wildlife Mangt. 28(3): 492-521. 1964.

Daily observations of duck broods living undisturbed in their natural environment and unaware of an observer's presence were made during the summers of 1950-51 at a 20 acre marsh in the Seney National Wildlife Refuge on the Upper Peninsula of Michigan. Observations were made of duck broods of the following species: Blue-winged teal (Anas discors); black duck (Anas rubripes); wood duck (Aix sponsa); mallard (Anas platyrhynchos); hooded merganser (Lophodytes cucullatus); ring-necked duck (Aythya collaris); and American widgeon (Mareca americana).

Favorable loafing spots were so much in demand that competition existed among broods for their use. Although these spots were defended by the hen occupying them, she and her ducklings were sometimes driven off by other brood hens. No instance was ever observed of a widgeon hen driving a ring-necked duck family off a mound, but several instances of the reverse were seen. The female and her brood usually left the loafing mound together after completing their period of sleep, although sometimes the hen left while the ducklings were still asleep. Similarly, hens often left their broods while they were feeding, to return after an absence of 15-75 minutes.

The duck broods exercised a considerable degree of mobility in their movements into and out of the study area. Methods of escape used by duck broods when frightened varied among the different species observed. With the exception of the widgeon, most brood hens usually tolerated the close approach of other adult ducks, provided they made no threatening move toward the young.

Loafing sites were extremely important in the daily activities of duck broods. Although no duck nests were found in the area immediately surrounding the study marsh, many of the broods first appeared there as downy young.

When existing rearing marshes became overcrowded, confusion prevailed among broods, resulting in lowered duckling survival. Under such conditions, establishment of additional small rearing marshes was recommended. For the study area, the maximum concentration of broods occurred July 18, 1950, when 15 broods, representing 0.75 brood/acre, were tallied; and 9 widgeon broods was the highest number of broods of a single species seen there during 1 day. There appeared to be no conflict between the ducks and the deer (Odocoileus virginianus), beaver (Castor canadensis), and muckrats (Ondatra zibethicus) which also inhibited the marsh. The mink (Mustela vison), however, was shown to be a potentially important predator.

U. Mich., Ann Arbor, Mich., 48104

361. Brenner, F. J. REPRODUCTION OF THE BEAVER IN CRAWFORD COUNTY, PENNSYLVANIA. J. Wildlife Mangt. 28(4): 743-747. 1964.

Data were collected on weight, pelt size, and the reproductive tracts of beavers (Castor canadensis) in Crawford County, Pa., during the trapping season.

The age at which beavers attain sexual maturity appeared to be 2 years. Embryos were found only in females classed as 2-year-olds and older. In a histological examination of the testes, spermatozoa were found only in 2-year-old or older males; these individuals also had an increase in sudanophilic activity, which indicated an increase in testosterone production over yearling animals.

The number of embryos varied from one to nine with a mean of 5.50 per pregnant female. The potential litter size was 5.04 embryos per female of those that were pregnant or had been pregnant before complete or partial resorption occurred. Resorption occurred in 16.7 percent of the pregnant females examined. These resorptions reduced the potential population of young by 6.9 percent. All resorptions occurred in 2-year-old females which had bred for the first time. The adult females produced larger potential litters than did the 2-year-old animals.

The breeding season in Crawford County extended from the last of January through February.

Pa. State U., University Park, Pa., 16802

362. Mann, G. E. IMPROVED TECHNIQUES FOR AERIAL WETLAND SURVEYS. J. Wildlife Mangt. 28(3): 575-580. 1964.

Techniques used in an intensive aerial wetland survey of more than 13,000 square miles of western Minnesota pothole range in 1961-62 were reported. Need for the survey resulted from the accelerated prairie pothole acquisition program of the Fish and Wildlife Service. Wetland types described by Martin et al. (1953) were used.

Using light aircraft and experienced charter pilots, two men with thorough knowledge of the territory were able to cover the area in two seasons. Flights 1,200-1,300 feet above ground level, averaging 70 miles per hour, proved most satisfactory. Complete coverage of all sections in a township by the 1-mile-wide inspection method took approximately 20-25 minutes.

Completed township platsheets with standardized survey information provided a biological basis for systematic negotiation for purchase of fee title and easements of waterfowl marshes. This aerial technique proved to be an economical, rapid, and accurate method to locate and establish acquisition priorities.

Bur. Sport Fisheries & Wildlife, Fergus Falls, Minn., 56537

363. Mathisen, J., Radtke, R., and Byelich, J. THE USE OF AMMONIUM NITRATE FOR MARSH BLASTING. Trans. North Amer. Wildlife and Natural Resources Conf. 29: 143-150. 1964.

Various methods have been used to reclaim or improve extensive emergent-type marshes and potholes for wildlife.

Ammonium nitrate, a common commercial fertilizer, when mixed with No. 2 fuel oil and detonated with a dynamite primer, has proved to be an economical and effective technique in removing portions of dense emergent vegetation from extensive marshes and potholes, developing open water, and creating favorable habitat for wildlife.

FS, USDA, Cass Lake, Minn., 56633

364. Kopischke, E. D. UNUSUAL MORTALITY FOR DIVING DUCKS. J. Wildlife Mangt. 28(4): 848-849. 1964.

Nearly 90 diving ducks were found dead in a drainage ditch below the outlet of a 29-inch drain tile. Laboratory examinations indicated that the ducks had drowned. Field investigation suggested that they had been drawn into an open 12-inch vertical tile intake that provided rapid drainage for a flooded field about 1-1/4 miles above the outlet. Puddle ducks were not drawn into the tile.

Minn. Dept. Conserv., Madelia, Minn., 56062

365. Chupp, N. R., and Dalke, P. D. WATERFOWL MORTALITY IN THE COEUR D'ALENE RIVER VALLEY, IDAHO. J. Wildlife Mangt. 28(4): 692-702. 1964.

Waterfowl mortality in the Coeur d'Alene River Valley has aroused public concern since the early 1900's. An investigation and evaluation of the valley as waterfowl habitat was begun in 1954. Information from this and subsequent studies leaves little doubt that contamination of the Coeur d"Alene River Valley by mine wastes from the Coeur d'Alene mining area is the prime cause of the bird losses.

Analyses of numerous soil, plant, and waterfowl specimens collected in the valley showed abnormally high concentrations of lead, zinc, and copper. The toxic effects of the assimilated mine wastes, coupled with environmental stress in the winter and early spring, are apparently sufficient to produce the mortalities noted. Management considerations associated with alleviating the problem of bird losses in the Coeur d'Alene River Valley were discussed briefly.

U.S. Bur. Sport Fisheries and Wildlife, Spokane, Wash., 99210

SUPPLEMENT

Problems Indirectly Affecting the Application of Soil and Water Conservation Practices

See Also 166, 198, 290, 341, 348.

366. Goss, R. L. PREEMERGENCE CONTROL OF ANNUAL BLUEGRASS (POA ANNUA L.). Agron. J. 56(5): 479-481. 1964.

Dacthal at 10 pounds, zytron at 15 pounds, dipropalin at 6 pounds, trifluralin at 2 pounds, betasan at 15 pounds, and enide at 4 pounds per acre all demonstrated highly significant preemergence control of annual bluegrass when applied to the soil surface prior to planting. All of the above herbicides effectively inhibited either germination or subsequent growth and development of seedlings. It appeared that betasan had a longer residual life than the other chemicals.

The action of these preemergence herbicides seems to be largely associated with inhibition of root development. Plants from treated soil resumed normal root growth when transferred to a nontoxic environment.

The six chemicals listed can possibly be used to reduce or eliminate annual bluegrass from turfgrass by preventing seedling establishment. The turfgrass manager must use discretion in timing applications to cover the annual bluegrass germination periods and allow at least 12 weeks before overseeding to desirable grasses.

Wash. Agr. Expt. Sta., Wash. State U., Pullman, Wash., 99163

367. Burnside, O. C. HERBICIDES: A TWO-EDGED SWORD. Nebr. Expt. Sta. Q. 9(3): 8-10. 1964.

Herbicides, although necessary to crop production, are a two-edged sword, and their residues cannot be ignored.

Five years of chemical fallow research in western Nebraska showed that a least 2 lb./A. of atrazine, monuron, or simazine were needed to control weeds during the fallow year. Yet in 1962, atrazine at 1.6 lb./A. on fallow land destroyed wheat planted 10 months later.

Soil residue problems were sometimes observed after using s-triazines (atrazine, simazine, propazine), substituted ureas (monuron, diuron), and benzoic acids (2,3,6-TBA, dicamba, PBA). Other herbicides also showed soil residue problems.

Herbicides either are lost or become nontoxic to plants in the soil by one or more of the following ways: (1) Microbial breakdown; (2) leaching; (3) adsorption; (4) volatilization or steam distillation; (5) chemical breakdown; (6) photodecomposition; or (7) plant uptake. All organic compounds are eventually broken down.

The label should give the name of the herbicide, the chemical formula, amount of active and inert ingredients, suggested uses approved by the U.S. Department of Agriculture, directions for use, precautions and warnings, antidote, manufacturer, and other helpful information. Read and follow label directions.

Do not consider herbicides a cure-all for all weed control problems. Select an adapted crop variety, buy clean seed, treat the seed, prepare a good seedbed, plant at the proper rate and date, place starter fertilizer properly, rotate crops suitably, use necessary insecticides, and cultivate on time.

Nitrogen fertilization can be considered one of our best herbicides. Also, Nebraska research shows that growing corn, sorghum, and soybeans in narrow rows increases crop yields and decreases weed yields.

Proper application methods were given, along with ways to improve the residue problem.

U. Nebr. Col. Agr., Agr. Expt. Sta., Lincoln, Nebr., 68503

368. Hill, R. D., and Schwab, G. O. PRESSURIZED FILTERS FOR POND WATER TREATMENT. Trans. ASAE 7(4): 370-374, 379. 1964.

Pressurized cartridge, granulated carbon, rapid sand, and precoated carbon filters were evaluated on privately owned water systems and at the water treatment laboratory of the Ohio Agricultural Experiment Station, to determine their effectiveness in filtering farm pond water. The following conclusions were made:

1. The cellulose acetate and felt cartridge filters were unsatisfactory for pond water as they were unable to remove the small-sized particles normally found in pond water.
2. Pressurized granulated carbon filters were effective in reducing chlorine residuals but not in reducing turbidity and color. Poor filtration of turbidity was due to the large size of the carbon granules and the small size of the turbidity particle. True color was not absorbed by the carbon to any large degree due to sediment buildup on the carbon granules.
3. Pressurized rapid sand filters were not effective in reducing turbidity and color. Chlorine residuals were reduced 16 to 87 percent. Daily backwash did not improve filter performance over weekly backwash.
4. Preliminary studies indicated that feeding alum before a pressurized rapid sand filter markedly improved filter performance.
5. Precoated carbon filters were effective in reducing turbidity, color, and chlorine residuals to a low level. The major drawback of this filter was short filter runs.

U.S. Public Health Serv., R. A. Taft Sanitary Engin. Cent., Cincinnati, Ohio, 45201

369. Hill. R. D., Schwab, G. O., Malaney, G. W., and Weiser, H. H. FILTRATION AND DISINFECTION OF FARM POND WATER. Ohio Agr. Expt. Sta. Res. B. 966, 58 pp. 1964.

Methods of filtering and disinfecting farm pond water were studied for a 3-year period. A slow sand filter and a pressure rapid sand filter were evaluated as primary filters, and a cartridge, precoated carbon, and granulated carbon filter as secondary filters. Disinfection studies were carried out with brom-chlor-dimethyl-hydantoin (BCDH) and chlorine as disinfecting agents.

The slow sand filter proved to be effective in the removal of turbidity and apparent color at flow rates between 15 and 150 gallons per day per square foot, except during a period of high rainfall and heavy runoff in the early spring. Filtration took place primarily in the schmutzdecke, but particles penetrated as deep as 8 inches into the sand. Bacterial densities were decreased by the filter alone, but not to an acceptable level. Prechlorination increased the length of filter run but did not improve filter performance other than in bacteria removal. A fiber-glass mat placed on top of the sand filter did not improve its performance.

Pressure rapid sand filters were not effective in removing turbidity or apparent color. Filtration was markedly improved when alum was added to the water at the rate of 50 mg./l. ahead of the filter.

The cartridge and granular carbon filters performed poorly as secondary filters. On the other hand, the precoated carbon filter was effective in reducing the turbidity and apparent color to an acceptable concentration. The short life of the filter would limit its use because of frequent maintenance.

Similar efficiencies in bactericidal action were obtained with chlorine and BCDH. With both chemicals, poor results were obtained when the contact time between disinfectant and water was short and/or the disinfectant residual was low. The advantage of BCDH was that greater residuals were possible without developing bad odors and tastes. A filter preceding the BCDH was necessary to prevent the formation of a slime layer on the granules.

Tables, graphs, and photographs.

Ohio Agr. Expt. Sta., Wooster, Ohio, 43210

Radioactive Fallout

370. Myhre, D. L., Menzel, R. G., Roberts, H., Jr., Frere, M. H., Amemiya, M., Beale, O. W., Timmons, D. R., and Wood, E. H. REDUCTION OF STRONTIUM-90 UPTAKE BY CORN AND SOYBEANS WITH DEEP PLACEMENT, IRRIGATION, AND SOIL AMENDMENTS. Agron. J. 56(5): 463-467. 1964.

Field experiments were initiated in 1960 to evaluate methods of reducing Sr-90 uptake under four widely varying soil and climatic conditions. The locations included Georgia, South Carolina, Minnesota, and Iowa. Each experiment consisted of a modified split-plot design with factorial combinations of shallow and deep placement, minimal and frequent irrigation, no-calcium and high-calcium amendments, and normal-potassium and high-potassium amendments.

A significant reduction in Sr-90 content in both corn and soybean grain was obtained by deep placement but not by irrigation. Calcium treatments reduced Sr-90 in both grains in Georgia, and potassium reduced Sr-90 in corn grain in Minnesota. The maximum reduction was only about 50 percent, which is far from adequate decontamination. Foliar deposition probably contributed about one-half of the total content of Sr-90 in corn and soybean grain.

SWCRD, ARS, USDA, State College, Miss., 39762

371. Nishita, H., and Taylor, P. INFLUENCE OF STABLE SR AND CA ON SR90 and CA45 IN SOILS AND CLAY MINERALS. Soil Sci. 98(3): 181-186. 1964.

Experiments were conducted to study the influence of stable Sr and Ca on the behavior of tracer quantities of Sr-90 and Ca-45 in soils and clay minerals, using an equilibrium batch method.

The sorption of tracer quantities of Sr-90 and Ca-45 depended on the concentration of the stable Sr and Ca and on the kind of soil or clay mineral. Under conditions of low ionic concentration in the equilibration suspensions, more Sr-90 was sorbed in Ca systems than in Sr systems. Under conditions of relatively high ionic concentrations, there was no appreciable difference in Sr-90 sorption between Ca and Sr systems. Since the initial trace quantities of Sr-90 were sorbed firmly, the sequence of addition of the tracer to the soil in relation to stable Sr and Ca was important.

U. Calif., Los Angeles, Calif., 90024

372. Frissel, M. J., and Poelstra, P. A THEORETICAL APPROACH TO THE MOVEMENT OF STRONTIUM THROUGH SOILS. Soil Sci. 98(4): 274-277. 1964.

Thornthwaite et al. (1960) developed a mathematical description of the transport of Sr-90 through a soil. Using the data of Miller and Reitemeier, they evaluated an empirical parameter; namely, the leaching efficiency. A theory for the calculation of this leaching efficiency was presented. The difficulties of comparing the calculated and evaluated leaching efficiencies were discussed. Taking these difficulties into account, the order of magnitude of the values calculated were concluded to be quite satisfactory. The differences between theory and experiment increase in the order 0.005 N $CaCl_2$, deionized water, 0.005N NaCl. The great difference in leaching efficiency between 0.005 N $CaCl_2$ and 0.005 N NaCl was explained theoretically.

Inst. for Atomic Sci. Agr., Wageningen, Netherlands.

373. Hoss, D. E. ACCUMULATION OF ZINC-65 BY FLOUNDER OF THE GENUS PARALICHTHYS. Trans. Amer. Fisheries Soc. 93(4): 364-368. 1964.

The amounts of Zn-75 accumulated from water and from food by flounder (Paralichthys sp.) were measured and compared. When concentration factors were calculated, it was found that flounder concentrated Zn-65 to higher levels from food than from water. The initial rate of accumulation of Zn-65 from water was dependent on the concentration of the radionuclide in the water.

Bur. Com. Fisheries, Radiobiological Lab., Beaufort, N.C., 28516

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